Arizona Department of

Transportation

Traffic Safety for School Areas Guidelines

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Arizona Department of Transportation
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Table of Contents

Section 1
FOREWORD

Traffic control in school areas is a highly sensitive subject. If all the demands of parents and others were met, there would have to be many more police and adult guards for school duty; and may more traffic signals, signs and markings. Such demands, however, are not always in line with actual needs.

Analyses often show that many locations, school crossing controls requested by parents, teachers and other citizens are unnecessary and costly and tend to lessen the respect for controls that are warranted. It is therefore important to stress the point that regardless of the school location, safe and effective traffic control can best be obtained through the uniform application of realistic policies, practices and standards developed through engineering studies.

Pedestrian safety depends in large measure upon public understanding of accepted methods for efficient traffic control. This principle is never more important than in the control of pedestrians and vehicles in the vicinity of schools. Neither school children nor vehicle operators can be expected to move safely in school zones unless they understand both the need for traffic controls and the ways in which these controls function for their benefit.

Non-uniform procedures and devices cause some confusion among pedestrians and vehicle operators, prompt wrong decisions, and can contribute to accidents. In order to achieve uniformity of traffic control in school areas, comparable traffic situations must be treated in the same manner. Each traffic control device and control method described in this guide fulfills a specific function related to specific traffic conditions.

The type of school area traffic control used, either warning or regulatory, must be related to the volume and speed of traffic, street width and the number of children crossing. For this reason, the traffic controls necessary in a school area located on a major highway would not necessarily be needed on a residential street away from heavy traffic. Yet, the important point to be made is that a uniform approach to school area traffic controls must be developed to assure the use of similar controls for similar situations (which promotes uniform behavior on the part of vehicle operators and pedestrians).

This publication is intended to provide guidelines for the implementation of the MUTCD part VII, in accordance with ARS 28-797.

Section 2

Site Selection

The safe and effective movement of vehicular and pedestrian traffic on school property should be a primary objective of school administrators, school architects and traffic engineers. Control of traffic around school areas is one of the most important factors to be considered when selecting and designing a school site plan. With proper site selection, tomorrow's traffic problems can be eliminated or treated at the design stage, thus averting a possible tragedy and eliminating unnecessary expenditures for correcting problems which surface after the school is in operation. The suggestions in this guide need not be considered absolute; on the contrary, they should be tailored to fit local conditions. Consideration should be given to all forms of traffic entering and leaving the school area: buses, parents, faculty, service and student vehicles, bicycles, pedestrians, and emergency vehicles. A traffic engineer should be consulted before plans are finalized.

This chapter is directed to all personnel involved either in designing and operating new school facilities or in renovating and reconstructing existing facilities. The guidelines, however, can be applied to all school sites as part of a regular review to ensure that existing facilities are as safe as possible. Persons involved in school site planning and design should consult with local government and safety agencies for assistance. State and local officials should also be consulted regarding standards, codes, ordinances and permits.

The following traffic control principles will, if adhered to, provide a safe environment for school sites. They should be given the highest possible priority when evaluating new sites, expanding current sites, or reviewing existing school operations.

An important aspect of site selection is the review of the present and future land use surrounding the school area. For undeveloped areas, such a review should determine whether future development in the area would complement a new school. Property zoned for residential use is a good example of land use complementing a school area. In developed areas a land use review would aid in the location of school driveways. An estimate of future traffic volumes on abutting streets, the need for traffic control devices, and the need for pedestrian control should all be reviewed prior to the design stage to avoid future traffic problems. Local zoning should be reviewed to

Determine future land development and possible new traffic patterns.

Prior to land acquisition and specific planning for school sites, the school board or superintendent should determine certain basic parameters:

1. Current and projected school population to be served in the district.

2. Grades to be served (elementary, junior high, middle school, and high school).

3. The size of the school (this should include projections for future growth).

4. Scope of extracurricular activities – playground area, athletic fields, auditorium facilities, community rooms, etc.

5. Current transportation policies in the district.

6. Size and shape of the school grounds.

7. Abutting and on-site roadway systems, including parking, loading zones and accessibility.

8. Proximity to high speed highways or arterials which would require crossing by school children.

When these elements have been identified, the actual land area needed for the school site can be calculated by the school architect and planner. Sites available within a school district are usually limited, and too often the final selection is based primarily on initial cost with secondary consideration given to some of the parameters cited above. Such a selection, based on cost alone, is shortsighted and an prove costly in future years if the site does not have sufficient area to accommodate future building and related facilities, as well as essential transportation facilities.

During the initial stages, local authorities should be contacted to determine present and future zoning ordinances and transportation systems.

The actual site location will depend on consideration of the following factors:

1. Amount of land needed.

2. Zoning or land use.

3. Evaluation of land presently owned by the school district.

4. Funds available for land acquisition.

5. Access to street system and classification of adjacent streets (residential, major arterial, state highway, county primary, etc.)

6. Relationship to other facilities.

7. Landscaping requirements.

8. Availability of utilities.

9. Compatibility with adjacent land owners.

10. Future plans for expansion.

Donated land or land presently owned by the school district is not always the “best buy” for a new school site. Increased travel times, accessibility, and land use problems often will more than offset the initial dollar savings. A new school is a long-range investment and should be analyzed from that point of view.

If the site is not readily accessible from an adequate street network, traffic congestion and potentially hazardous conflicts will develop. Further, if the site is not adequate in size, it cannot efficiently accommodate all facilities necessary for safe school operations. In addition to the buildings, these items include:

1. Separate loading zones for
   a) Students transported by parents
   b) Students transported by bus

2. Separate parking facilities for
   a) faculty and staff
   b) visitors
   c) students

3. Pedestrian and bicycle routes

4. Access for
   a) emergency vehicles
   b) service vehicles

4. Playgrounds and athletic fields

6. All necessary roadways

7. Bicycle racks

8. Access for handicapped students

Elementary Schools

School sties which serve younger children should be located as close as possible to the areas in which the students reside. This will minimize walking distances and also reduce traffic congestion created by parents driving children to and from school.

Elementary schools should be located such that young children should not have to cross a major street on their way to school. When this is not possible, the number of students required to walk across major streets should be minimized.

Access streets should be wide enough for safe traffic flow. If streets cannot accommodate two-way traffic flow, curb parking should be prohibited in advance of school pedestrian crossings, at driveway areas, and at building entrances. Such parking restrictions protect school pedestrians by maximizing visibility and, at the same time, make vehicle access safer.

Middle Schools, Junior High and Senior High Schools

Sites for middle schools, junior and senior high schools are usually twice as large as those for elementary schools. Adequate sites are not usually available in or contiguous to residential areas, so different criteria should be applied in the selection process. T he basic size of the school and related facilities should be established. This will be determined by the service area of the school, the student population within that area, and the transportation system required to service the students.

As with elementary school sites, a high school site should also be readily accessible from a street system capable of handling school generated traffic (i.e. buses, service vehicles, delivery trucks, and automobile traffic created by faculty, staff, parents and students). The use of local residential streets for primary access to high school sites should be avoided.

On-site space should be provided for the buildings, the recreation and athletic facilities, faculty and staff parking, visitor parking, student parking, bus loading zones, bus storage area, bicycle racks, interior roadways, etc.

Student parking needs are quite flexible and vary considerably among school areas. It is best to evaluate the potential number of student vehicles and provide adequate on-site space for them. This eliminates the need for students to park on residential streets, which can lead to unneeded congestion and a poor relationship with neighbors.

When all of these elements are considered, the final selection of a school site may have to be made on the basis of compromise. Of the sites considered, one may have adequate area, but limited access; another may be accessible, but not provide sufficient area for all of the desired facilities; still another may have many shortcomings, but be priced so attractively that it is given a preferential rating. In the latter case, it should be remembered that the long-term problems that may accrue at such a site often outweigh the short-term price advantage.

Section 3

On-Site Safety

Good school site planning stresses the maximum feasible separation of these basic modes of transportation: 1) buses, 2) cars and motorcycles, 3) pedestrians and 4) bicyclists. In addition, there are many more requirements that should be considered in the planning stages of developing a school site. The following items list important safety considerations with guidelines for each.

Regardless of all other parameters, two key safety principles should be rigidly adhered to:

1. Adequate physical space should be provided for all modes of transportation to the degree that each is found on the school site or planned for the future.

2. The physical routes provided for the basic school modes of transportation should be separated as much as possible from each other.

Adherence to these two basic principles will increase the safety of all persons utilizing the school site.

Another on-site consideration is the location of school drives and pedestrian crossings, with respect to the street layout on all sides of the school. Site planners should provide information regarding these items and all abutting land use for a minimum of 100 feet in all directions from the school site. This will help determine the location of pedestrian sidewalks, possible school crossings, loading zones, and building entrances.

School Bus Zones

IT IS ABSOLUTELY ESSENTIAL THAT BUS ZONES BE SEPARATED FROM ALL OTHER TRANSPORTATION ACTIVITIES. An estimate should be made of the number of buses that will be expected to be within the bus loading and unloading zone at any given period of time. The estimate should include the total number of buses used at the school, the number of drop off and pick up cycles run by each bus during its longest period (loading or unloading), and the length of the buses to be used at the location. These facts will dictate the dimensions for the school bus loading zone.

Where the bus loading and unloading driveway re-enters the street system, consideration should be given to providing two exit lanes – one for right turning buses and one for left turning buses. Consideration should also be given to the length of storage available from the street exit back to the point where buses are lined up against the curb for loading and unloading.

The bus loading and unloading zones should be designed for one-way movement, with the passenger door on the building or curb side. It is highly recommended that this be a counterclockwise movement.. The movement should only be clockwise if the school bus driveway encircles the school building-practice which is not recommended.

Bus zones should also be designed so that buses never have to back up. Recommended school bus loading patterns are shown in Figures 7.2-1 and 7.2-2. The exact dimensions of these zones will of course vary, depending upon the number of buses projected to be delivering or picking up students at any given time. Standard arrival and dismissal times will have a direct bearing on the length of the bus zone. If expansion of the school busing program seems likely, the zone should certainly be designed with provisions for expansion in mind.

Parent Pick-Up & Drop Off Zone

Parent pick-up and drop-off zones are often overlooked in school design, but are very important. Students deserve a safe space to be dropped-off and picked-up. The provision of adequate drop-off zones minimizes illegal standing or parking near schools and helps prevent problems such as blocking school buses and driveways.

As in the bus zone, traffic movement should be in a one-way, counterclockwise direction. Cars should be parked parallel so there is no need for them to back up. This counterclockwise motion virtually guarantees that students will leave the vehicle and step immediately upon the sidewalk, and vice-versa. The student loading zones should be completely separated from the bus zone. Parent pick-up zones should be separate from other parking lots. They shall be separated from bus loading zones. An estimate of the probable number of cars that may be in the pick-up zone at any one time should be made. Parent loading zones often become dangerously congested for short

Figure 3-1
Off-Street School Bus Loading and Unloading Zone

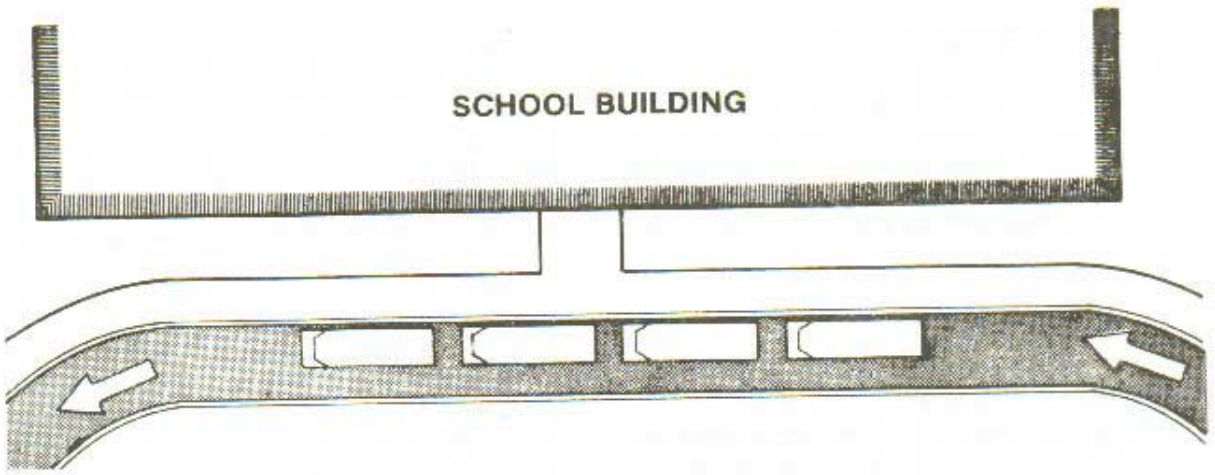
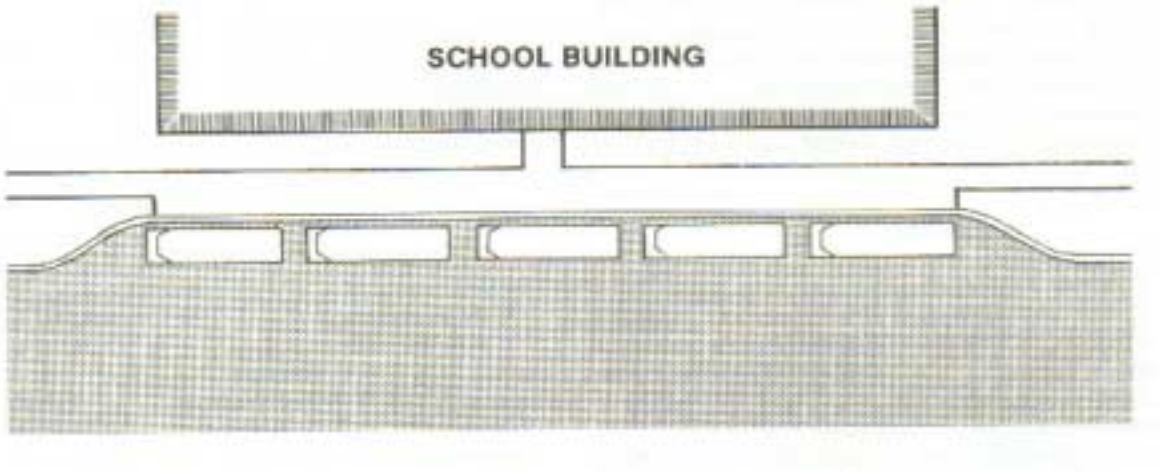


Figure 3-1 shows the most common and preferred "bumper to bumper" practice of loading and unloading students. It can be used where space, especially driveway width, is a physical constraint. The inherent shortcoming to this practice is that only the front and rear buses can move should an emergency occur. It may also be difficult to continue loading or unloading operations if one bus breaks down. This system, however, provides maximum safety for students during loading and unloading operations.

Figure 3-2
On-Street School Bus Loading and Unloading Zone



Since on-site space is often limited, FIGURE 3-2 shows how an on-street bus zone may be utilized. It assumes that the existing street can be widened immediately adjacent to the school site. These zones should only be located on low-volume, low-speed streets. These should be used when it is necessary to modify an existing site but they are not recommended for new sites. It is very important that traffic controls be installed to keep motorist out of this type of zone. Pavement markings and signs assist greatly; however, unauthorized use of the zone will be a continual problem. Regardless of the system used for loading or unloading, buses may be parked in such a manner that students never have to go between buses and so that the rear emergency door can open.

periods during school dismissal. Staggering dismissal times help alleviate this problem. Parent pick-up and drop-off zones are shown in figures 4 5-1 and 4 5-2.

Streets surrounding the school zone should be posted so as to prohibit parents from parking in areas that would require students to cross traffic. (A.R.S. 28-901)

Faculty, Student, and Visitor Parking

Schools should provide adequate off-street parking for faculty, student and visitor needs.

If space permits, separate parking facilities should be provided for faculty, student and visitor parking. Visitor parking, however, may be combined with faculty parking but never with bus zones or the student pick-up area. The visitor parking area should be located close to a nearby street and be convenient to the school administrative offices. The following guidelines can be used when estimating how many parking spaces need to be provided:

1. There should be one parking space for each staff member and an additional 10 percent of that for visitor parking.

2. Any school policy on students driving should be considered during the design of the student parking lots. These parking lots should be laid out with enough excess capacity and flexibility to accommodate special events, such as graduation, plays, shows and sporting events. Therefore, lighting, walkways, and driveways should be designed to accommodate both normal daily traffic and occasional high traffic volumes associated with special events. Typical parking lot arrangements are shown in chapter 4.

Pedestrian and Bicycle Routes

Sidewalks should be provided for all students who are required to walk or ride bicycles to school. These routes should be designed to cross a minimum number of internal driveways and never cross the school bus loading zone. Sidewalks should be wider than those in adjacent neighborhoods due to higher concentrations of pedestrian and bicycle traffic. Where significant bicycle traffic will exist, eight to ten foot wide sidewalks should be made available near the school building in a relatively visible and secure location to discourage theft and yet be accessible to sidewalks. Student walking and bicycle routes should be separated from student pick up and bus loading zones.

Parents or school officials should provide training for students who choose to ride their bikes to school, especially younger children. Bicyclists must be made aware of local ordinances and state law requirements governing bicycle operation while in the street and on sidewalks. Cyclists must be taught that they are required to ride with traffic while in the street and obey all traffic signs and signals.

Elementary age children should not ride in major streets or busy collector streets. Young cyclists should be encouraged to walk their bikes while in crosswalks to preserve their rights as pedestrians, give motorists more time to react, and to avoid conflicts with other children walking in the crosswalk. Some elementary schools have established minimum age requirements and passage of a bike safety course before they are allowed to ride to school. Bicycle rodeos are a popular and successful way to educate students on how to ride safely and properly maintain their bikes. Cyclists should be strongly encouraged to wear a safety helmet while riding.

Playground Area and Fencing

Playground facilities should be located so that students walking between school buildings and the playground need not cross streets, roadways, or driveways. Fences should be used where students may be tempted to wander from the playground area. Fences also minimize those accidents which result from children chasing balls which have rolled into streets and driveways. Chain link fence can be very helpful, and even necessary at times, to separate students on the school grounds from vehicles. Fencing can also be used to improve walking patterns and prevent jaywalking.

Service Roads

Delivery and maintenance vehicles should not be parked along city streets. (See Emergency Vehicle Access.) Space for service and delivery turn-offs and adequate service driveways connecting to main drives is the appropriate way to accommodate service vehicles.

Driveway & Roadway Design Criteria

Many local agencies have their own *driveway* design standards. However, in the absence of local standards, the following may be considered as a minimum standard:

1. At school driveways along streets, a 40 foot minimum radius should be used on the curb returns.

2. The driveway width at the curb returns should be at least 30 feet, but preferably 40 feet.

3. At ingress and egress points, a relatively flat grade is desirable (not more than 2% for at least 100 feet from the street). This flat grade will provide better operation during adverse weather conditions.

4. A maximum grade of 5% is recommended on internal school bus drives.

5. Internal two-way roadways or two lane one-way roadways on school sites should have a minimum width of 26 feet face-to-face of curb or 24 feet edge-to-edge of an uncurbed facility. Consideration for wider pavement widths should be made when roadways are curvilinear.

Minimum turning paths for passenger cars, single trucks, and school buses are available in a design manual entitled "A Policy on Geometric Design of Highways and Streets" which is published by the American Association of State Highway and Transportation Officials (AASHTO). These design criteria should be used when designing curves on internal roadways. Curbs are desirable on all drives and roadways to provide good drainage flow, provide additional parking controls, and better define roadways. The location of drives, structures, and landscaping shall permit adequate sight disturbances for drivers and pedestrians alike. Safe stopping sight distance values are listed in the AASHTO design manual referenced above.

Emergency Vehicle Access

Where driveways or parking lots are not contiguous to the school buildings, it is recommended that consideration be given to use the high strength sidewalks, 15 feet wide, with radii at turns which would be sufficient to permit turning a large emergency vehicle. Access to these structural sidewalks can be provided via mountable curbs. Through the use of such features, emergency vehicles can gain access to all sides of a school building, even through a street, driveway, or aisle does not run close to the building. It is recommended that all roadways on school properties, with the exception of loading and unloading zones, be signed "No Parking or Standing, Fire Lane". This traffic regulation should be reinforced by the adoption by the local agency of a private property traffic control order allowing the enforcement agency to enforce the restrictions. Delivery and school service vehicles should be made to rigidly obey these parking restrictions because drivers have a tendency to "follow the leader," especially if they observe "official" vehicles ignoring their own rules. Assistance in developing traffic control restrictions can be obtained from local or state enforcement agencies.

Traffic Control Devices

All traffic control devices (signs, signals, and pavement markings) shall conform at the time of installation to the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD), as adopted and amended by the State of Arizona, and the provisions of this guide. Within the school site, the responsibility for traffic controls and their enforcement belongs with the school. However, officials should make use of the MUTCD when regulating traffic on the school site. The conformance of controls to a uniform standard (as in the MUTCD) will aid traffic movements and safety. Guide signs directing motorists to buildings, parking lots, and offices should also be in conformance with MUTCD.

A review of all traffic controls should be conducted to ensure their clarity to motorists and conformance to the MUTCD. Traffic Signs should never be hidden by buildings, trees, shrubs, etc. All pavement markings should be repainted before each school year and again later in the school year, if necessary. All too often, pavement markings are viewed as a one-time investment, when in fact such markings require periodic repainting.

It is very important that all traffic controls conform to the MUTCD. "Special" signs should be avoided. The MUTCD addresses most traffic control problems and contains controls designed to meet these problems. Conformance to the MUTCD will improve traffic flow, safety, and enforcement of traffic regulations.

Requirements for the Handicapped

Safety and building specifications explain in detail facilities that must be provided for handicapped students. These specifications must conform to the requirements of the 1992 Americans with Disabilities Act. It is recommended that these standards be reviewed pertaining to each school site.

Section 4

Off-Site Safety

Frequently, studies of pedestrian movements leading to a school site reveal a failure of pedestrians to cross in concentrations at logical crossing locations. The primary reason for school crossing controls not being warranted at many of the various locations requested on the State Highway system usually is a lack of sufficient pedestrian volumes at any of the locations. Unfortunately, it is not uncommon for very young children to be allowed to wander to school by whatever route their youthful minds prefer. In such instances, it is apparent that parents are willing to abdicate their responsibilities by placing the entire burden for pedestrian safety on a traffic control device.

It is vitally important that consideration be given to locating logical and "safe" routes in each town where the maximum number of school-age pedestrians can benefit from their use. The routes should provide maximum protection for the pedestrians by taking advantage of any existing traffic controls. Further, a primary goal of such routes should be the concentration of pedestrian crossing at selected points on major streets or highways.

Community responsibility for developing an effective school pedestrian safety program should be a combined effort of the school, the parents, and the local authority.

School Responsibilities

School responsibilities, under the school superintendent or an assigned staff member, should include:

A. Development of a "School Route Plan" for each school district. Such a plan consists of a street map showing the location of the school and the routes to be used by the students en-route to and from the school. The plan should be designed to provide a maximum of protection for children by taking advantage of existing traffic controls. Children should be required to walk somewhat longer distances when by doing so they can take advantage of existing crossing aids.

B. Instructing the students on the use and purpose of the "School Route Plan".

C. Making periodic field reviews of the plan to ensure that the "Suggested Routes" are being used. Special attention should be given to unsafe activities of school children. The need for traffic control, trimming of weeds, etc. should be directed to the attention of the appropriate governmental agency.

D. Making an annual review of the "School Route Plan" to determine the need for revisions.

E. Training and supervising adult crossing guards.

F. Reviewing the location of school bus stops.

Parental responsibilities, through local Parent Teacher Organization's in cooperation with school administrators should include:

A. Instructing the children on the use of the "School Route Plan" and ensuring that they use it. The plan is not limited only to school use, but it applies to all pedestrian travel around the school.

B. Directing to the attention of the school administrator any safety problems that may develop during the school year.

Local Authorities Responsibilities should include:

A. Working with school authorities in developing the "School Route Plan".

B. Conducting demonstrations and lectures on pedestrian safety and "Rules of the Road".

C. Any school crossing program should have a well-balanced blend of engineering, education, and enforcement – the ideal approach to effective traffic controls.

Section 5

Safety On Existing School Sites

On existing, fully developed school sites, traffic conflicts may exist or be created by changing population patterns, school board policies, curriculums, and busing policies. For example, an older school with grades one through eight with no busing may, because of a change in policy, become an elementary school requiring busing. In this situation, there would be a change in the number of parents driving students to and from school and a change in pedestrian walking patters; however, most critical of all, a bus zone would be needed.

This section shows how existing school sites may be effectively and economically modified to adapt to these changes and to reduce the impact of created hazards.

All of the following examples illustrate just a few of the ways that the basic principles discussed in the previous sections may be applied to existing school sites.

As with new sites, each existing site presents a unique situation which must be evaluated on an individual basis. There is no single, simple solution which will improve all situations. On the contrary, each of the basic principles must be considered, as appropriate, in analysis of an existing site

Figure 5-1

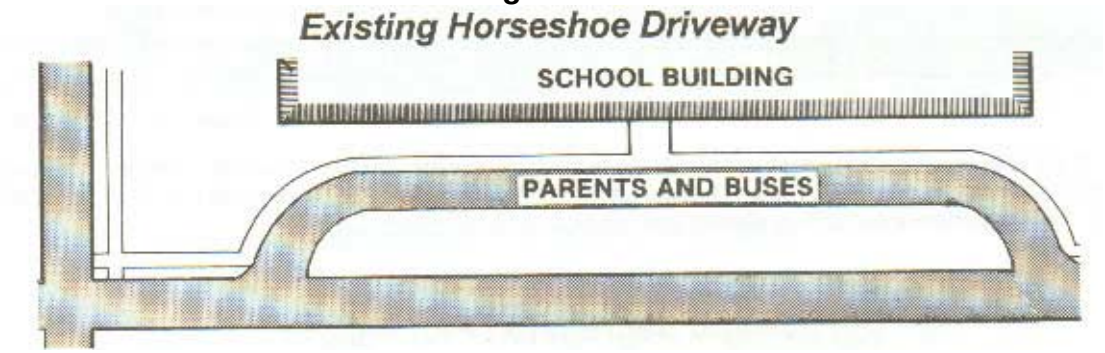


FIGURE 5-1 is an example of an existing school with a horseshoe driveway in front of the building used for both buses and parent's cars. It is assumed that the area has become congested to the point that it is a hazard for both the students and the drivers of these vehicles. Buses are being blocked by parents' cars and students are running between vehicles to meet their parents.

Figure 5-2

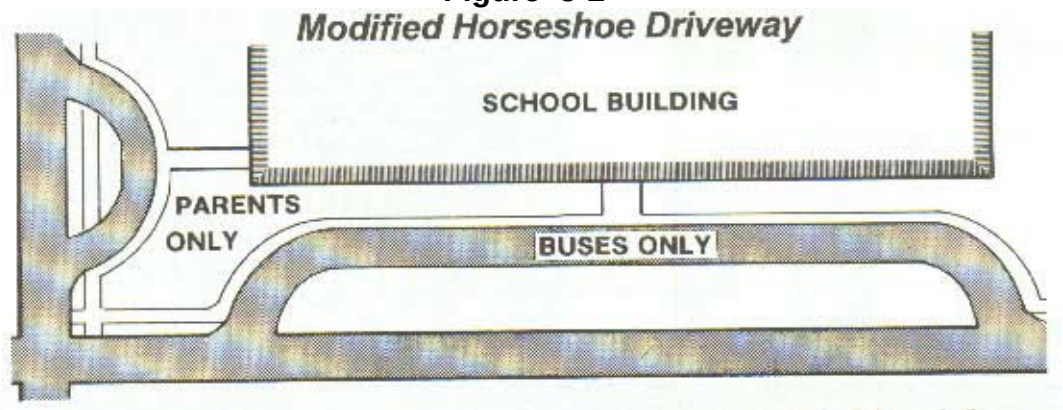


FIGURE 5-2 depicts how a safer zone and more efficient operation may be achieved through the separation of the bus and student pick up zones. Here a separate loading area was constructed on the side of the school for student pick up. The buses are able to parallel park next to the sidewalk for safe and easy loading and unloading within their zone. The one-way counterclockwise pattern is used in both zones.

Figure 5-3

Figure 5.3
Single Unsegregated Parking Lot

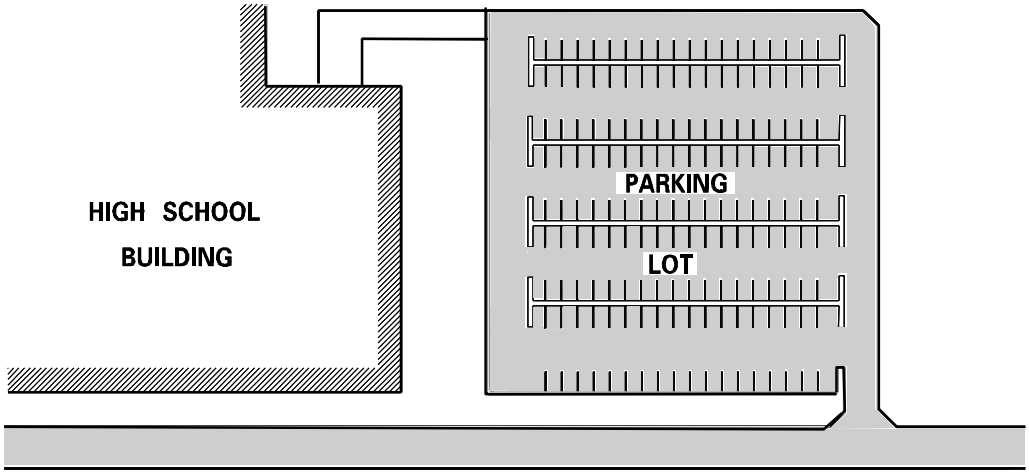
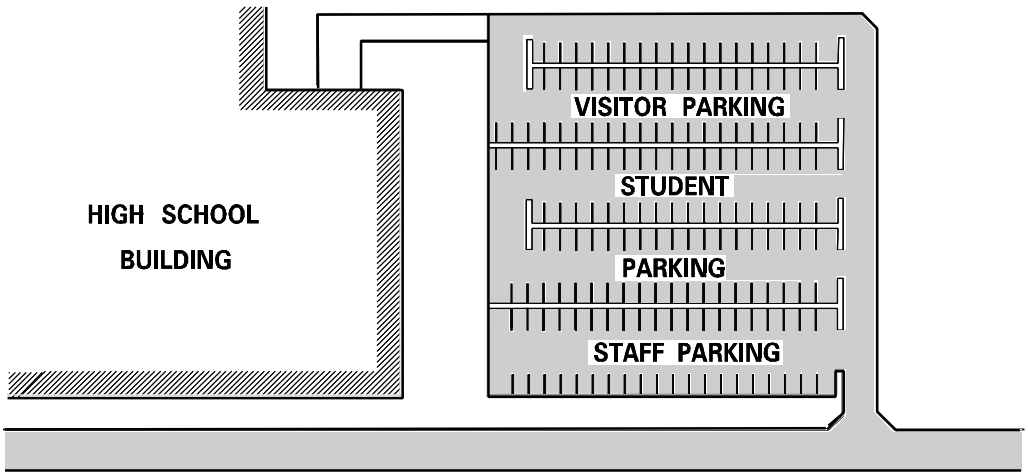


FIGURE 5.3 is an examlple of a high school with a large adgancent parking lot. Presently, visitors, staff and students may park anywhere in this lot. These parking areas should be separated, if possible, by signing and pavement marking. Adding concrete curbs may also be necessary.

Figure 5.4
Single Segregated Parking Lot



As shown in FIGURE 5.4 the lot has been divided to provide "reserved" visitor parking near the main entrance, and student parking.

Figure 5.5

Uninterrupted Perimeter Road

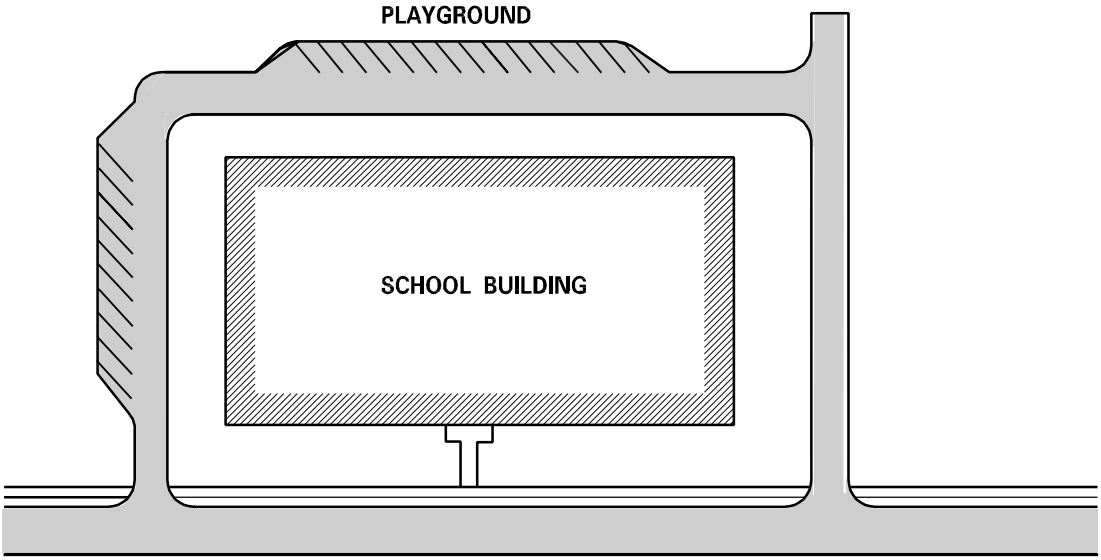


FIGURE 5.5 is an example of an elementary school that is bound on all sides by either a driveway or street. As a result, the students are constantly exposed to vehicular traffic.

Figure 5.6

Interrupted Perimeter Access

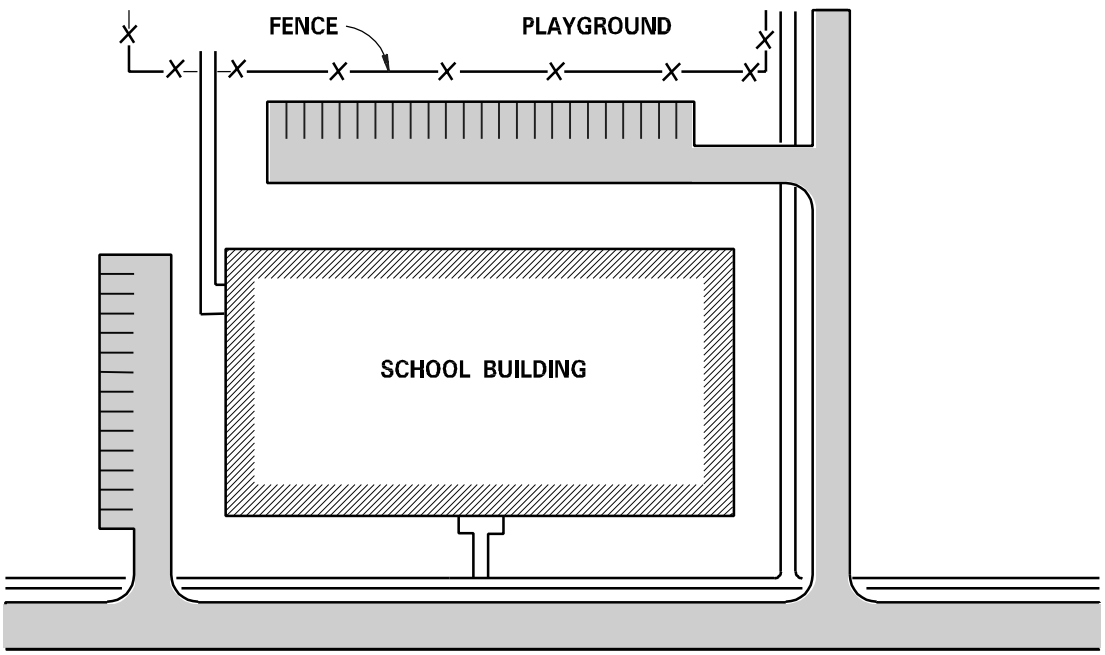


FIGURE 5.6 shows where sidewalks have been provided for safe walkways and bikeways along the streets; the driveway is interrupted, the playground is fenced, and a walkway is provided from the school to the playground. This may be done rather inexpensively and provides a far greater measure of safety for the students.

Figure 5.7

Parking Between Playground and School

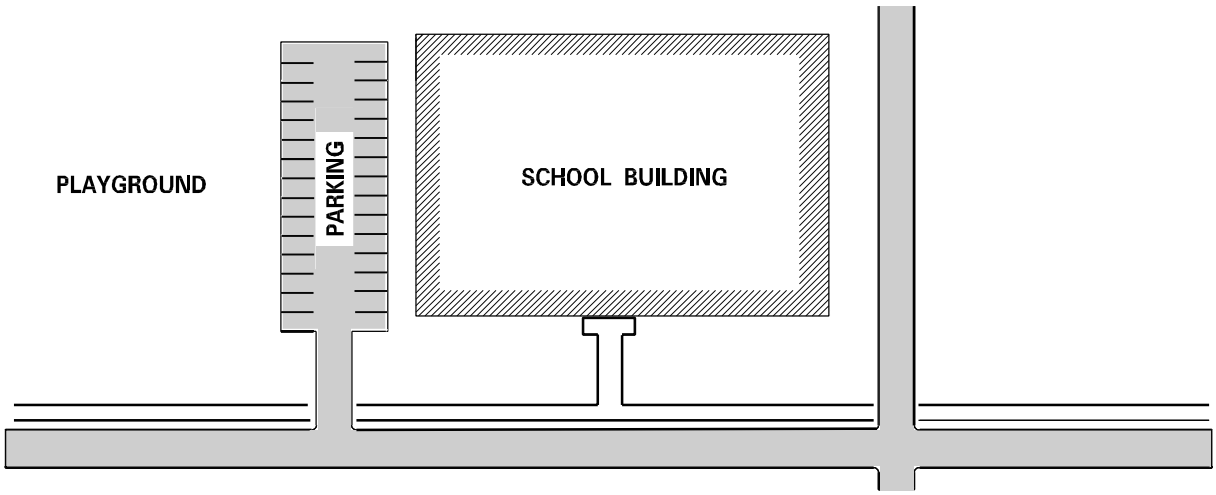
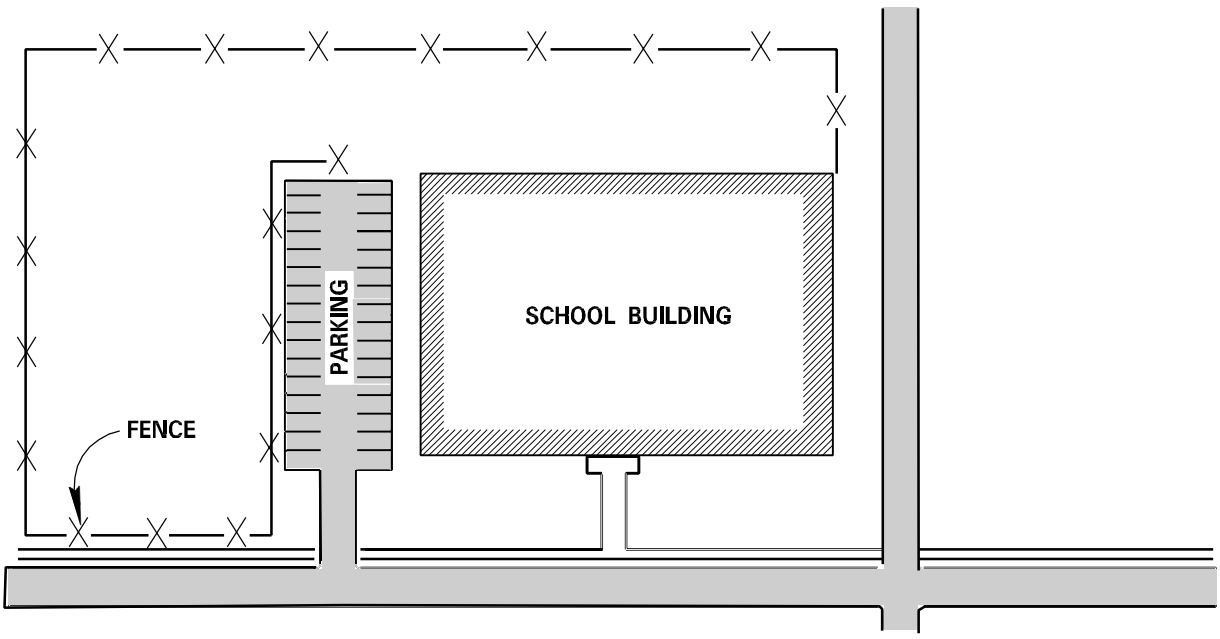


FIGURE 5.7 is an example of a school built with a parking lot and playground which allows students to cross the parking lot to reach the playground. Also, the students are not protected from the vehicles in the parking lot.

Figure 5.8

Parking Removed From Student Access



In FIGURE 5.8 a fence around the playground has been added to confine students to the playground area. The fencing also provides a barrier that prevents balls from rolling from the playground into the streets or parking lot.

Section 6 (Previously Section 7.5. Referred to as Section 7.5 in the AZ MUTCD Supplement)
Arizona School Crossing Controls

School crossings shall be established in compliance with the Arizona Revised Statutes article 10 section 28-797 (see Appendix C), and the decision to establish a particular crosswalk at a particular location shall be made on the basis of an engineering study of the location. This section sets forth procedures and requirements for the establishment of school crossings in Arizona; however, it is not intended to be a substitute for engineering judgement.

The school crossing analysis and warrant procedure used by the Arizona Department of Transportation on State Highways is contained in Appendix B. Additionally, a comprehensive program can be found in the Institute of Transportation Engineers publication, "A Program for School Crossing Protection". A copy of this document may be purchased from the Institute of Transportation Engineers, 525 School Street, Suite 410, Washington, D.C. 20024-2797.

The following sections of the Arizona Revised Statutes (A.R.S.) are relevant to the establishment of school crossings. Each is discussed briefly following the text of the A.R.S.

Abutting School Crossings
ARS Section 28-797-A

"The Director, with respect to state highways, or the officer, board or commission of the appropriate jurisdiction, with respect to county highways or city or town streets, by and with the advice of the school districting governing board or superintendent of schools, may mark or cause to be marked by the Department or Local authorities, crosswalks in front of each school building or school grounds abutting thereon where children shall be required to cross the highway or street."

1. This section of the law places the responsibility for the location of all abutting school crossings on the state highway system with the Director of the Department of Transportation, and for the county highways or city or town streets with the appropriate local authorities

   Requests for crosswalks on roads off the state highway system should be addressed directly to the authority having jurisdiction over those roads.

2. School authorities are responsible for the proper operation of school crossings. No school crossing evaluation on the state highway system may be undertaken without a written request signed by the school district governing board or superintendent of schools for that district or the superintendent of a private or parochial school. The request should be addressed to the Arizona Department of Transportation, Traffic Engineering, 206 South 17th Avenue, Room 061R, Phoenix, Arizona 85007.

3. Upon receipt of request for evaluation by the Department of Transportation for crossings on state highways or by local authorities for crossing on county highways or city or town streets, a traffic operations investigator, together with an official of the school, if the school do desires, will make an inspection of the location. This inspection will consider, but not necessarily be limited to the following factors:

   a. Physical conditions of the area

   b. Vehicular volume, speed and or other conditions pertaining to traffic.

   c. Number and age of children who will use the crosswalk.

   d. Proposed method of operation of the school crossing by school authorities.

4. Upon consideration of the above information, together with the report and recommendations of the investigator, the Director or local authority may approve or disapprove the school crossing. When it has been determined that a school crossing is warranted and that the school crossing will increase safety, an agreement shall be signed by the Director of State Highways or the local authority to authorize the crossing. The agreement shall indicate the location of the crosswalk and all portable signs and may indicate the location of the permanent signs. A typical agreement is shown in Appendix D. The school authority shall sign the agreement indicating acceptance of the responsibility for the operation and maintenance of the crossing in accordance with the requirements of

the state law and the provisions of this guide.

5. If for any reason the investigator recommends disapproval of a request for a school crossing, the applicant may request a review by the Director or local authority.

Non-Abutting School Crossings A.R.S. Section 28-797-B

"Additional crossings across highways not abutting on school grounds may be approved by the department, or local authorities, upon application of school authorities, with written satisfactory assurance given the department or local authorities that guards will be maintained by the school district at the crossings to enforce the proper use of the crossing by school children."

1. The same procedure shall be followed as outlined above for abutting school crossings.

2. For non-abutting crossings, the agreement shall include assurance that guards will be maintained by the school district at the crossing to enforce the proper use of the crossing by school children.

School Crossings On Unpaved Highways or Streets A.R.S. Section 28-797-H

"Notwithstanding any other provisions of law, a school crossing may be established on an unpaved highway or street adjacent to a school when the agency of appropriate jurisdiction determines the need for such school crossings on unpaved highways and streets shall be marked by the use of signs as prescribed in the Manual on Uniform Traffic Control Devices."

1. The same procedure shall be followed as outlined above for abutting school crossings.

2. A school crossing on an unpaved highway shall be marked, shown in Figure 7.A-6 in Appendix A.

Restrictions on Establishing School Crossings

1. At no time shall a school crossing be used as a device to control vehicular speed, except as stated in A.R.S. 28-797 at a bona-fide installation where children are required to cross the street or highway.

2. School crossings normally should not be installed between intersections on major streets. Mid-block crossing locations present the driver with an unexpected situation which they are not prepared for. Furthermore, operation of a school crossing, with its 15 mph speed limit, can seriously affect the operation of adjacent intersections.

3. In general, the establishment of school crossings at signalized intersection is not recommended. A signalized intersection already provides the safest, most controlled environment for pedestrian crossings. If additional controls are needed at a signalized intersection, consideration should be given to providing an adult crossing guard to assure that children only cross during the pedestrian interval of the cycle.

   School crossings shall not be established at signalized intersections on state highways. If an intersection having a school crossing on a state highway is subsequently signalized, the school crossing agreement shall be cancelled and the school crossing signs and markings removed.

   School Crossings may be established at signalized intersections on roadways under local jurisdiction if the local authority determines, on the basis of a traffic study, the need for such a school crossing (A.R.S. 28-797.1).

4. A school crossing shall not be established on approaches where traffic is controlled by a stop sign. A stop sign is the least violated of all regulatory traffic controls. The establishment of a school crossing where traffic is already required to stop could cause serious confusion to motorists, encourage violations of the stop sign, and hinder the normal expected intersection approach. No additional safety benefits to pedestrians could be expected to result from installing a school crossing where a stop sign already exists.

5. A school crossing should not be established within 600 feet of a signalized intersection, a four-way stop intersection, or another school crossing when located on the same street. Since an Arizona school crossing is the most restrictive control on Arizona's streets and highways, it is critical that it be viewed as "reasonable" by motorists – thereby leading to a high level of voluntary compliance. Where two school crossings are established closer than 600 feet, research has shown that the second crossing in either direction is routinely

violated by drivers. Undoubtedly, this is due to a feeling on the part of motorists that they are being unreasonably imposed upon. The same behavior has been evidenced at crossings located close to signalized or stop sign controlled intersections.

6. A school crossing shall not be established at a location leading to an unprotected railroad track except at an established grade crossing.

7. A school crossing shall not be established at locations with inadequate sight distance.

8. A school crossing shall not be established on roadways less than 20 feet in width, since this in effect is a one-lane road.

9. School crossings should not be established at high schools. School crosswalks are reserved for the major crossing areas serving youths below high school age. Motorists normally are willing to defer to small children and as a result, voluntary compliance is high. High school age pedestrians have sufficient judgement and maturity to choose adequate gaps in traffic for their crossings. In effect, they are capable of functioning in traffic as adults. Because of their maturity, many high school-age pedestrians resent being controlled by a crossing guard. Furthermore, they would have a tendency to generate resentment in motorists if they took unreasonable advantage of the preference accorded them by an official school crossing.

10. School Crossings shall not be established at any school that has no walking students, or to create a drop off/pick up bay on the opposite side of roadway for the purpose of crossing children.

Methods of Operation
A.R.S. Section 28-797-D

"When such crossings are established school authorities shall provide, place, and maintain within the highway the portable signs indicating that school is in session, placed not to exceed three hundred feet each side of the school crossings, and "Stop When Children In Crosswalk" signs at school crossings. School authorities shall maintain these signs when school is in session and shall cause them to be removed immediately thereafter."

1. School authorities shall not delegate the responsibility for placing, furnishing, maintaining or removing the portable signs to any person who is not in the service of the school or school district.

2. Portable signs shall not normally be placed in the highway during the hours of darkness; however, if the opening or closing hours occur during the hours of darkness, portable signs shall be placed in the highway and the signs shall be reflectorized as required by Sections 2A-16 and 7B-5 of the MUTCD.

3. School authorities shall replace any portable signs when deterioration of the message or excessive damage to the signs is evident. It is extremely important that all traffic signs command the continued respect of the motoring public.

4. No portable signs shall be within the highway unless all required signs are in place, except when placing or removing the signs.

5. School authorities shall provide adult supervision at non-abutting crossings during periods of normal usage. These adult crossing guards shall be employed by the school district.

6. School authorities should provide adult supervision at abutting crossings wherever roadway and traffic conditions are such that adult supervision would materially improve safe operation of the crossing. These adult crossing guards may be either employed by the school district, be volunteers to have been trained and approved by the school district.

7. Portable signs shall be removed from the street or highway when a required guard is not on duty at the school crossing.

8. School crossing guards should be adults either employed by the school district – or, at the discretion of the school district, volunteers working under the supervision of the school district. The use of students as crossing guards or monitors is not recommended.

9. The legal obligation of the guard is to choose adequate gaps in traffic to enforce the proper use of the crossing by school children. Therefore, guards shall not direct vehicular traffic unless authorized to do so by authority of the jurisdiction in which the school crossing is located (A.R.S. 28-797-B and 28-627). The guard should more properly concentrate his attention on controlling the children and choosing adequate gaps in traffic in which to cross them.

10. At the discretion of the Arizona Department of Transportation and/or local authorities, crossing guards may use hand held stop signs.

11. School crossings shall not be installed for Adult Education schools or Universities.

A.R.S. Section 28-797-F

"When the clause 'School Is In Session' is used in this section, either referring to the period of time or to signs, it means during school hours or while children are going to or leaving school during opening or closing hours"

1. Time limitation on placement and removal of portable signs shall depend on the opening and closing hours for the individual school as follows:

   a. Signs shall not be placed more than 45 minutes before the beginning of the first class unless an engineering study has determined that the walking time from the crossing to the school is sufficient to justify additional time.

   b. Signs shall be removed within 30 minutes after dismissal of the last class unless an engineering study has determined that the walking time from the school to the crossing is sufficient to justify additional time.

   c. Where additional traffic control or school crosswalk use is necessary during times other than normal school operating hours, a written request for permission must be submitted to the local authority and written permission given before the crosswalk or other traffic control may be employed during other than normal school hours.

Restrictions on Operating School Crossings

1. Portable school crossing signs shall not be placed in the street or highway on Saturdays, Sundays, school holiday or during hours beyond the normal school day for extracurricular school activities, unless permission is obtained.

2. Portable signs shall not be installed as a permanent installation at the side of the road.

3. Adult supervision or bussing in lieu of school crossings should be used where children must cross high speed highways. Consideration must be given to over all safety.

4. When not in use, all portable signs shall be placed in a location or position such that the face of the sign will not be visible to approaching traffic.

5. School crossing shall not be installed so as to encourage unlawful pick up or discharge of student (A.R.S. 28-797).

6. Arizona School Crossing signs (S2-2, S4-5) shall not be used along with MUTCD school speed limit assemblies (S4-1, S4-2, S4-3, S4-4, S5-1).

Traffic Control Devices for School Crossings A.R.S. Section 29-787-C

"The sign manual shall provide for yellow marking of the school crossing, yellow marking of the centerline of the roadway and the erection of portable signs indicating that vehicles must stop when persons are in the crossing. The manual shall also provide the type and working of the portable signs indicating that school is in session, and permanent signs providing warning of approach to school crossings."

1. Markings

   a. School crosswalk markings shall be standard highway yellow.

   b. Crosswalk lines shall be a minimum of 10" wide and should not be spaced less that 6' apart.

   c. The centerline and/or lines(s), shall be as prescribed by the Manual of Uniform Traffic Control Devices, as amended.

   d. A solid yellow circle approximately 10-12 inches in diameter may be painted at the appropriate location on which the portable School Speed Limit signs (S4-5) may be placed when the school crossing is in operation.

2. Signs

   a. All signs shall conform to the Manual on Uniform Traffic Control Devices, as amended by the Arizona State Legislature (Appendix A).

   b. The following signs shall be used only as indicated in this guide:

1.) School Advance Sign (S1-1)

2.) School Crossing Sign (S2-1) (OPTIONAL)

3.) Stop When Children in Crosswalk sign (S2-2)

4.) School Speed Limit Sign (S4-5)

5.) No Parking Sign (R7-13)

6.) End School Zone Sign (at discretion of Local authority.

c. The School Advance Sign (S1-1) shall be used in advance of the School Crossing sign and where used the sign shall be permanently mounted on a post at the side of the highway not less than 150 feet nor more than 700 feet in advance of a school crossing. Local conditions shall determine the exact location of the School Advance sign.

d. The optional School Crossing Sign (S2-1), when used, shall be permanently mounted on a post at the side of the highway placed at the school crosswalk.

e. The "Stop When Children In Crosswalk" sign (S2-2) shall be mounted on a portable standard not less than 24" nor more than 30" from the bottom of the sign to the roadway. Under normal circumstances, two "Stop When Children In Crosswalk" signs shall be mounted back-to-back and placed at the crosswalk on the center line of the highway. On one-way, multiple lane streets, one or more "Stop When Children In Crosswalk" signs shall be mounted on separate portable standards and placed at the crosswalk.

f. The "School Speed Limit" sign (S4-5) shall be mounted on a portable standard not less than 24" or more than 30" from the bottom of the sign to the roadway. On four-lane, two-way roadways, the "School Speed Limit" sign shall be placed on the lane line. On one-way, multiple lane streets, each lane shall have a "School Speed Limit" sign either to the right or left. The "School Speed Limit" signs should be located in advance of the school crosswalk as follows:

1) 75 to 125 feed when operating speeds are 30 mph or less.

2) 125 to 200 feet when operating speeds are 35 to 45 mph.

3) 200 to 300 feet maximum where posted speed limit over 45 mph. Normally, school crossings SHOULD not be installed on roadways having POSTED SPEED LIMIT speeds in excess of 45 mph.

The location of the "School Speed Limit" signs shall be determined by the investigator after reviewing the conditions of each individual area involved. The location of the School Speed Limit Signs shall be measured from the near side of the school crosswalk.

g. On multi-lane roadways additional S2-2 and S4-5 portable signs may be used when a traffic and engineering investigation indicates that they are needed.

h. All on-street parking shall be eliminated on the approach between the school speed limit sign and the crosswalk during designated school hours. (See figures 7.A-1 through 7.A-7 in Appendix A.) On street parking should also be eliminated on the departure side of the crosswalk zone between the marked crosswalk and the school speed limit sign for opposing direction of traffic. No Parking signs shall be installed under provisions of A.R.S. 28-873 and in conformance with the Manual on Uniform Traffic Control Devices.

i. Typical examples of signing and markings for school crossings are contained in Appendix A.

Responsibility for Signs and Markings

The responsibility for furnishing or replacing signs, sign posts, portable sign standards and pavement markings is as follows:

1. Permanent signs S1-1, S2-1 No Parking and sign posts:

   a. Department of Transportation, on state highways.

   b. County, on county roads

   c. City or Town on city or town streets.

2. Portable signs S2-2 and S4-5 and portable standards:

   a. School district, private or parochial school for which the school crossing is authorized.

3. Pavement markings:

   a. Department of Transportation, on state highways.

   b. County on County roads

   c. City or Town, on city or town streets.

Section 7

Pedestrian Signals

Pedestrian signals are special types of traffic signal indications installed for the exclusive purpose of controlling pedestrian traffic. They are frequently installed at signalized intersections when engineering analysis shows that the vehicular indications cannot adequately accommodate the pedestrians using the intersection. Pedestrian signals have evolved over the years and are now effective, sophisticated traffic controls. Unfortunately, their necessary sophistication has resulted in common misconceptions being held by the very people they are designed to serve – the pedestrian! The following discussion tells when pedestrian signals are normally installed, how they function, and what the indications mean.

When are Pedestrian Signals Used?

Pedestrian signals are installed for a variety of reasons. Frequently they are installed:

- When the layout of an intersection is such that vehicular indications are not visible to pedestrians.
- If pedestrian volumes are very heavy, as in a central business district.
- When the traffic movements at an intersection are so complex that special efforts are necessary to be made to communicate with pedestrians.
- When a special pedestrian path has to be defined across a complex intersection.
- When pedestrians have to be given exclusive use of an intersection with all conflicting vehicular movements being stopped in the interest of safety.
- When the location is on the recommended route to school.
- When crossing a wide street and an appropriate clearance interval is needed.

How Do Pedestrian Signals Function?

There are two types of pedestrian signals: those with pedestrian detectors ("Push to Walk" buttons) and those without detection. Pedestrian detectors are normally installed at intersections when:

- Arrival rates of side street vehicles are occasionally low and pedestrians experience undue delay waiting for a vehicular indication to turn green.
- Vehicular green indications are too short to allow for a pedestrian to safely cross a wide street – in these instances the pedestrian push button causes the signal controller to "extend" the green time for both vehicles and pedestrians.
- Pedestrians can get "trapped" on median islands in the middle of a street.

What Do the Indications Mean?

Pedestrians signals consist of the illuminated words or symbols WALK and DON'T WALK. The meanings of the indications are as follows:

- A steady, illuminated WALK or symbol display means that a pedestrian may enter the roadway and proceed in the direction of the indication. While pedestrians have the right of way, they must still be alert for turning vehicles and motorists who may run the red light..
- A flashing, illuminated DON'T WALK or symbol display means that a pedestrian may not start to cross the roadway in the direction of the indication, but any pedestrian who has partly started his crossing during the steady WALK indication may continue to cross.
- A steady, illuminated DON'T WALK display means that a pedestrian cannot legally enter the roadway.

Common Misconceptions

There are several misconceptions about pedestrian signals and pedestrian detectors. They include:

1. The erroneous belief that the WALK indication should be displayed for the entire time required to

cross the street. The critical requirement in pedestrian signal timing is that opposing vehicles not be permitted to go before all pedestrians who have entered the roadway on the steady WALK interval have had adequate time to complete their crossings. The crossing interval does not terminate for pedestrians already in the roadway when the stead WALK ends and the flashing DON'T WALK begins. Enough time exists for any pedestrian who begins to cross the roadway during any part of the steady WALK interval, even if most of the actual crossing takes place during the flashing DON'T WALK interval. Essentially the steady WALK indication informs pedestrians that they may begin to cross the roadway. The flashing DON'T WALK provides a clearance intended for pedestrians who began their crossing during the WALK interval and essentially means "don't start crossing" for the late arrivals.

2. The mistaken belief that available pedestrian detectors don't have to be pushed to gain access to the roadway. Some pedestrians fail to push available detector buttons and instead proceed to cross by observing the vehicle indications. Since vehicles normally move faster than pedestrians, the green time needed to cross the intersection is less for a vehicle than for a pedestrian. If the detector is not used, the pedestrian indication remains at steady DON'T WALK, and the green time given by the vehicular signal is not always sufficient to permit a pedestrian to completely cross the roadway. When pedestrians do cross under these conditions, they are not only disregarding the traffic signal indications and are violating Arizona Revised Statute 28-646, but they may come into conflict with a vehicle legally using the intersection, thus jeopardizing their own safety and the safety of others.

3. The misconception that pedestrian signals and detectors automatically increase safety and should be installed at all signalized intersections. Every signalized intersection has to be evaluated independently. If the combination of signal timing, intersection layout, pedestrian volumes, and vehicular volumes are such that pedestrian signals and detectors are not needed, then they should not be installed. In addition to the substantial installation costs, pedestrian signals consume a significant amount of electrical power at a typical intersection. If the vehicular indications can safely accommodate pedestrian traffic, then there is no justification for spending scarce resources to install elaborate pedestrian controls. At some intersections, it may be that only pedestrian push buttons need to be installed.

Where pedestrian volumes are low and pedestrian signals are not needed, a pedestrian detector can be used to extend the vehicular green, if it would otherwise be too short for a pedestrian to cross.

Parent, Pedestrian and School Responsibilities

Parents and schools need to teach the children how to properly use pedestrian signals. Pedestrian signals assign right-of-way to pedestrians, in much the same way as vehicular signals do for vehicular traffic. However, they are no guarantee of safety. Pedestrians still have to exercise sound judgement when crossing a roadway. The following suggestions are offered in the interest of safety.

1. Before crossing a signalized intersection, always push the pedestrian push button if one is present. This will guarantee adequate crossing time.

2. If no pedestrian signal is present, push the pedestrian push button if one is available, and always cross as soon as the vehicular signal turns green. This will ensure that adequate crossing time will be available. Pushing the detector when the signal is already green will not cause the green time to be extended during that particular green interval. The next green interval will, however, be extended. If the green signal has been on for any length of time prior to your arrival, be very cautious about entering the roadway – the vehicular signal could be ready to turn red and you could be trapped out in the roadway when it changes!

3. When full pedestrian signalization is present, push the pedestrian detector and cross when the pedestrian indication turns to WALK. Don't panic when the indication turns to flashing DON'T WALK – there is still adequate time to cross before opposing traffic is released.

4. Whenever crossing a roadway, regardless of the presence or absence of pedestrian controls, minimize the time you spend in the roadway – don't saunter!

5. Always be attentive and watch for possible vehicular traffic turning across your path. By law, vehicles have to yield to pedestrians lawfully within the intersection. However, in any contest of right-of-way between pedestrians and vehicles the pedestrian will always lose. Too many epitaphs for former pedestrians could read – "But I had the right of way".

Section 8

Pedestrian Overpasses

Periodically, requests are received from concerned communities for pedestrian overpasses over major streets or highways near schools. While an overpass is the ultimate separation of the vehicular and pedestrian modes of travel, such structures are extremely costly and have definite disadvantages. Normally, more economical solutions are available to remedy school-age pedestrian conflicts with vehicular traffic. Unfortunately, pedestrian overpasses are frequently viewed as "cure-alls", with no thought given to whether or not the expenditure of millions of dollars of public funds is economically justifiable. Quite often, community requests for overpasses are emotional responses to symptoms, rather than attempts to solve underlying problems. For example, in areas where concerned parents are requesting an overpass, a traffic investigation all too frequently reveals that:

1. There is no "school route plan" in the community.

2. There is no pedestrian safety program in the schools.

3. Very young children are allowed to wander to school by whatever route their youthful minds prefer.

4. Parents are willing to abdicate their responsibility placing the entire burden for pedestrian safety on a traffic control structure.

5. Local law enforcement officials turn a blind eye to youthful pedestrian traffic violations.

6. Where traffic laws are enforced by conscientious law enforcement officials, outraged parents explain away the irresponsible behavior of their children by claiming that the fault is due to a lack of safety awareness on the part of the responsible engineers, not their children.

Aside from the enormous cost associated with a pedestrian overpass, an almost insurmountable problem exists in ensuring usage of the structure. No matter how well-intended are the efforts which lead to building an overpass, the pedestrian has to be physically forced to use the structure. Pedestrians, both young and old alike, will consistently choose the path of least resistance. Consequently, unless physical barriers are placed to prevent pedestrians from crossing the street or highway, the overpass will stand unused. Since the type of fencing required to channelize pedestrians onto an overpass must extend at least 600 feet on either side of the structure to be effective, questions of aesthetics and access to adjoining property usually preclude its installation on an urban street system.

On the Arizona State Highway System, the following research-based criteria is used in analyzing the need for a pedestrian overpass. To warrant consideration all six criteria shall be satisfied:

1. High vehicular volumes conflict with high pedestrian volumes, constituting an extreme hazard; and

2. Modification of school routes, busing policies, campus procedures, or attendance boundaries to eliminate the need for crossing is not feasible; and

3. Physical conditions make a grade separation structure feasible from an engineering standpoint, including pedestrian channelization to insure usage of the structure; and

4. Pedestrian movements can be restricted for at least 600 feet on each side of the proposed overpass; and

5. A demonstrated problem exists that simpler, more economic solutions have failed to remedy; and

6. The anticipated benefits to be derived from the overpass clearly outweigh the costs involved.

APPENDIX A

SCHOOL CROSSING SIGNS AND MARKINGS

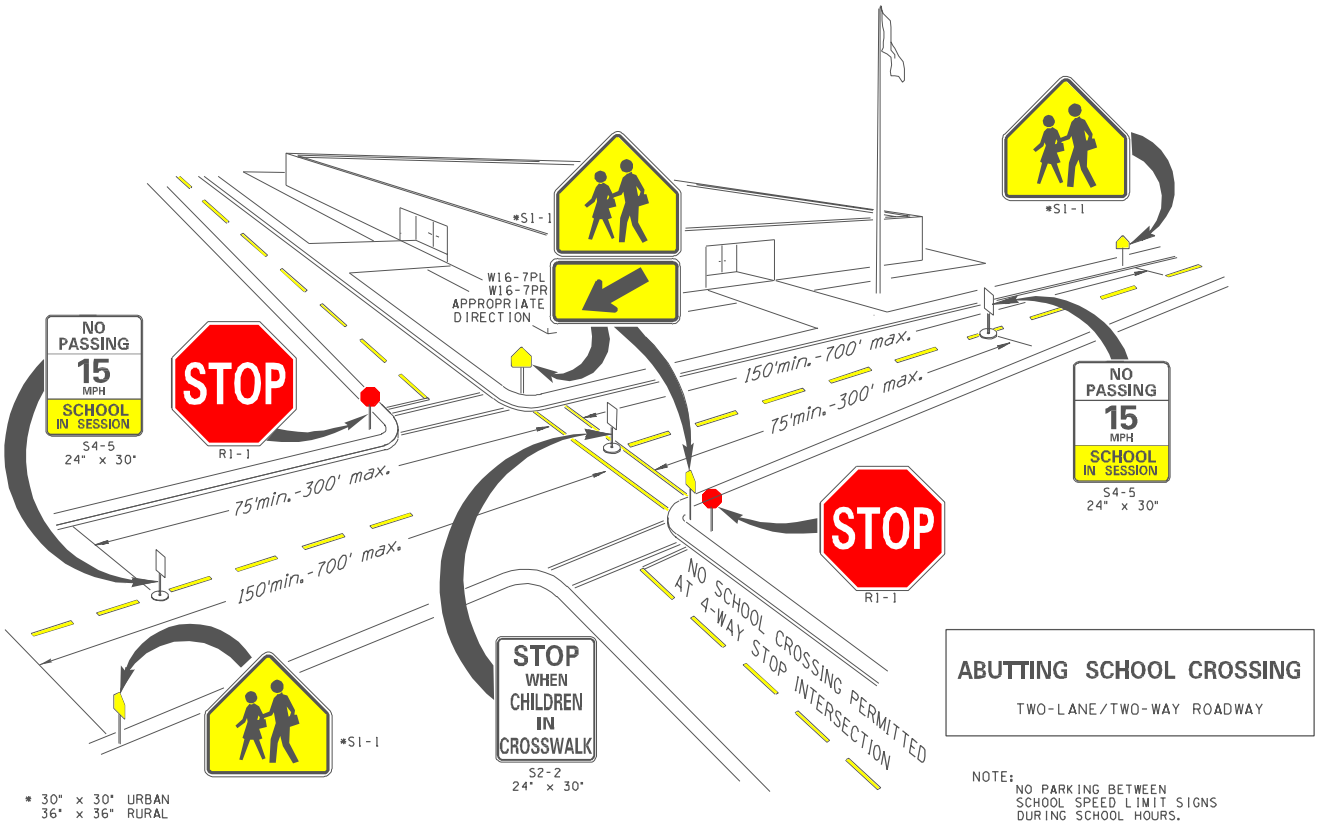
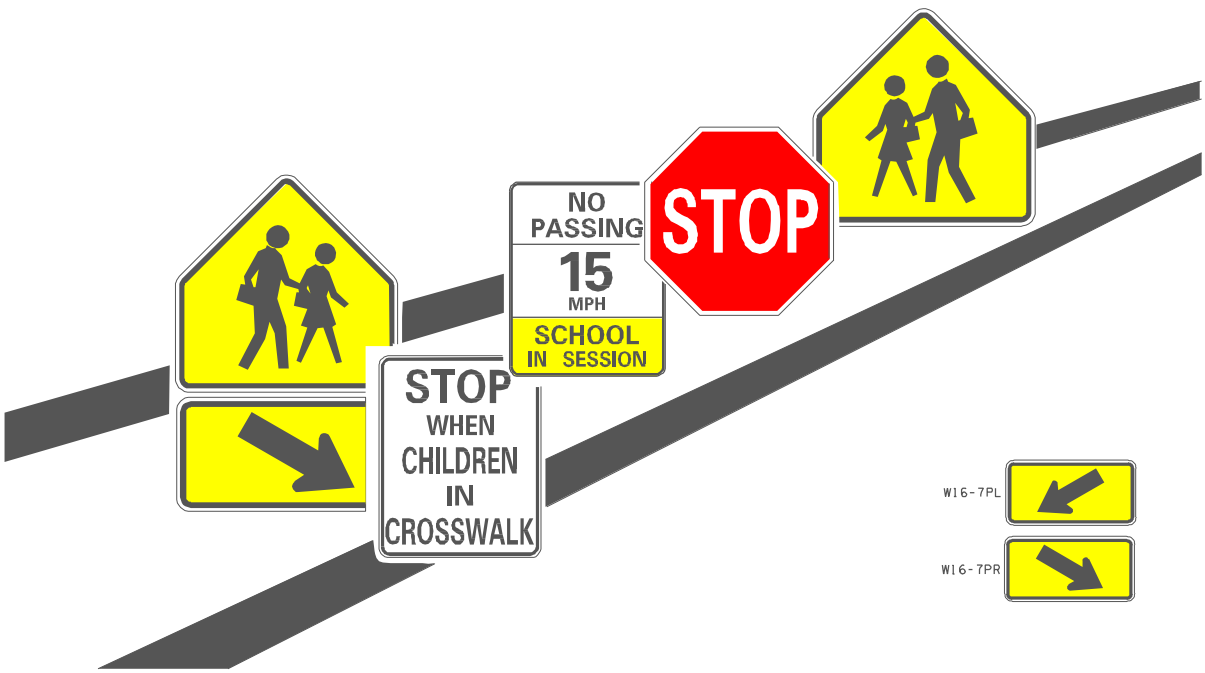
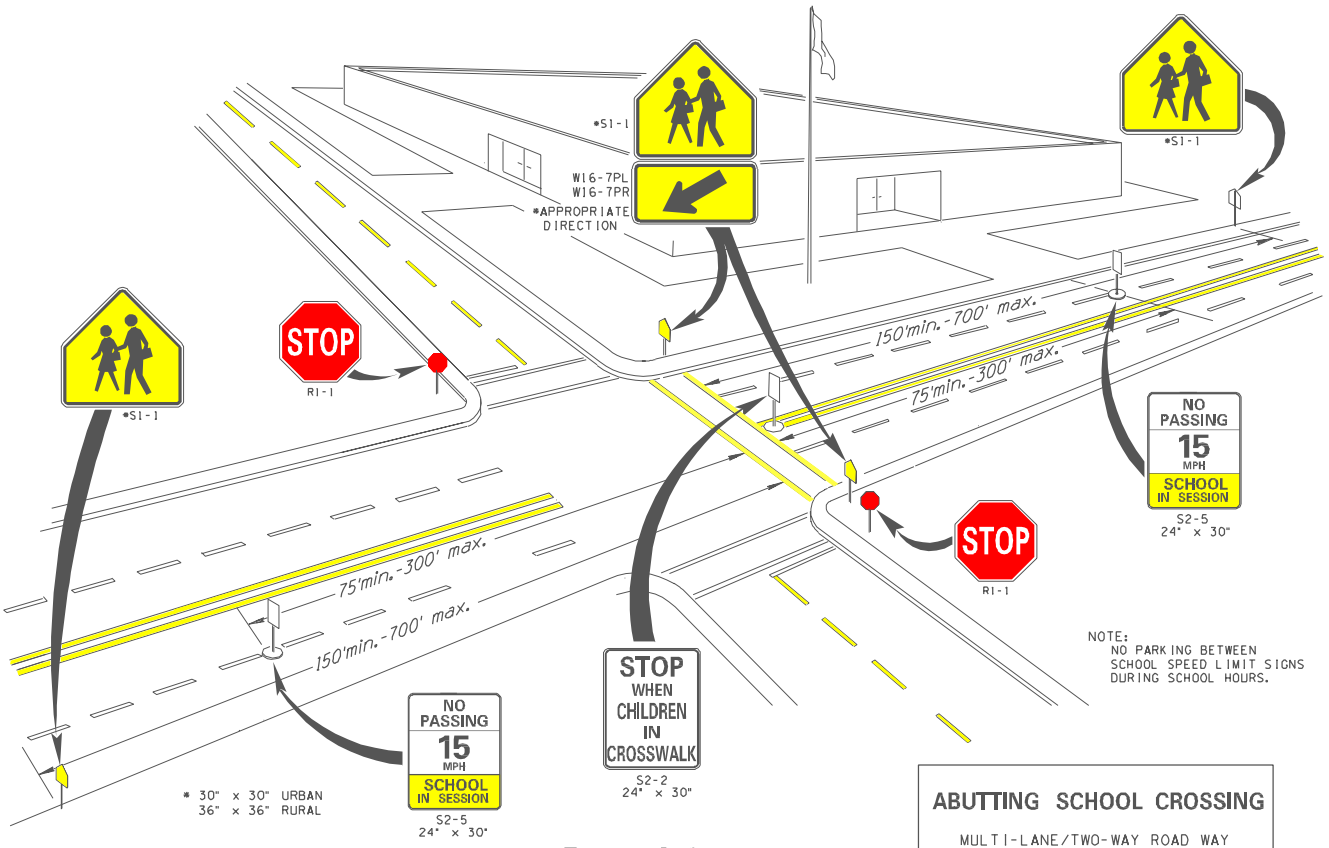


Figure A–1

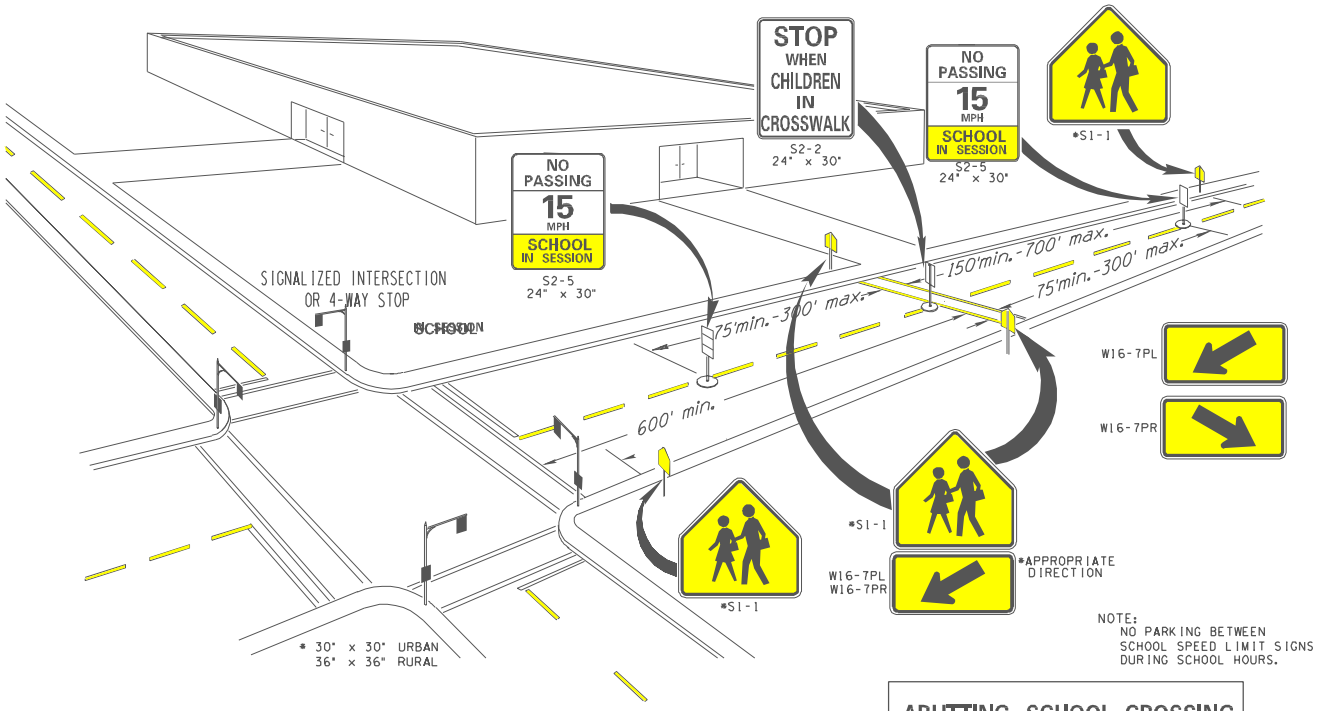




ABUTTING SCHOOL CROSSING

MULTI-LANE/TWO-WAY ROAD WAY

Figure A–2



ABUTTING SCHOOL CROSSING

TWO-LANE/TWO-WAY ROADWAY

Figure A–3

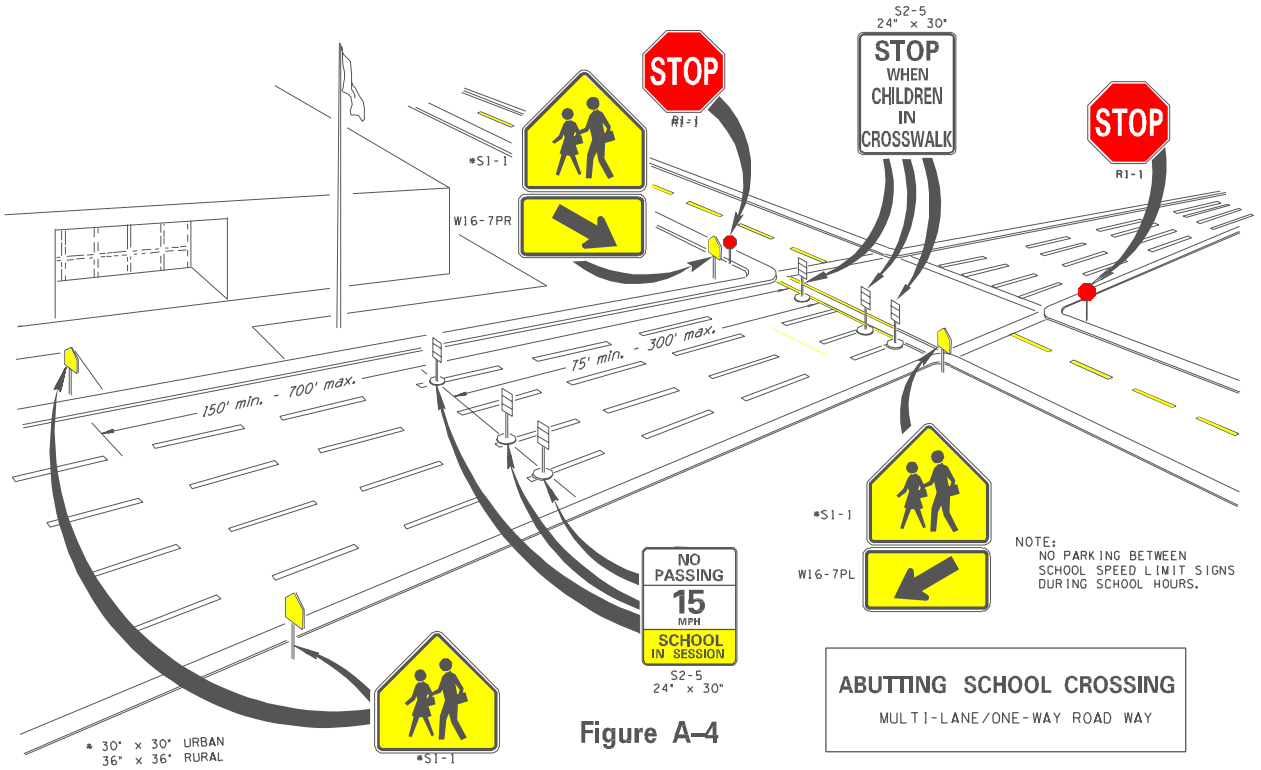


Figure A–4

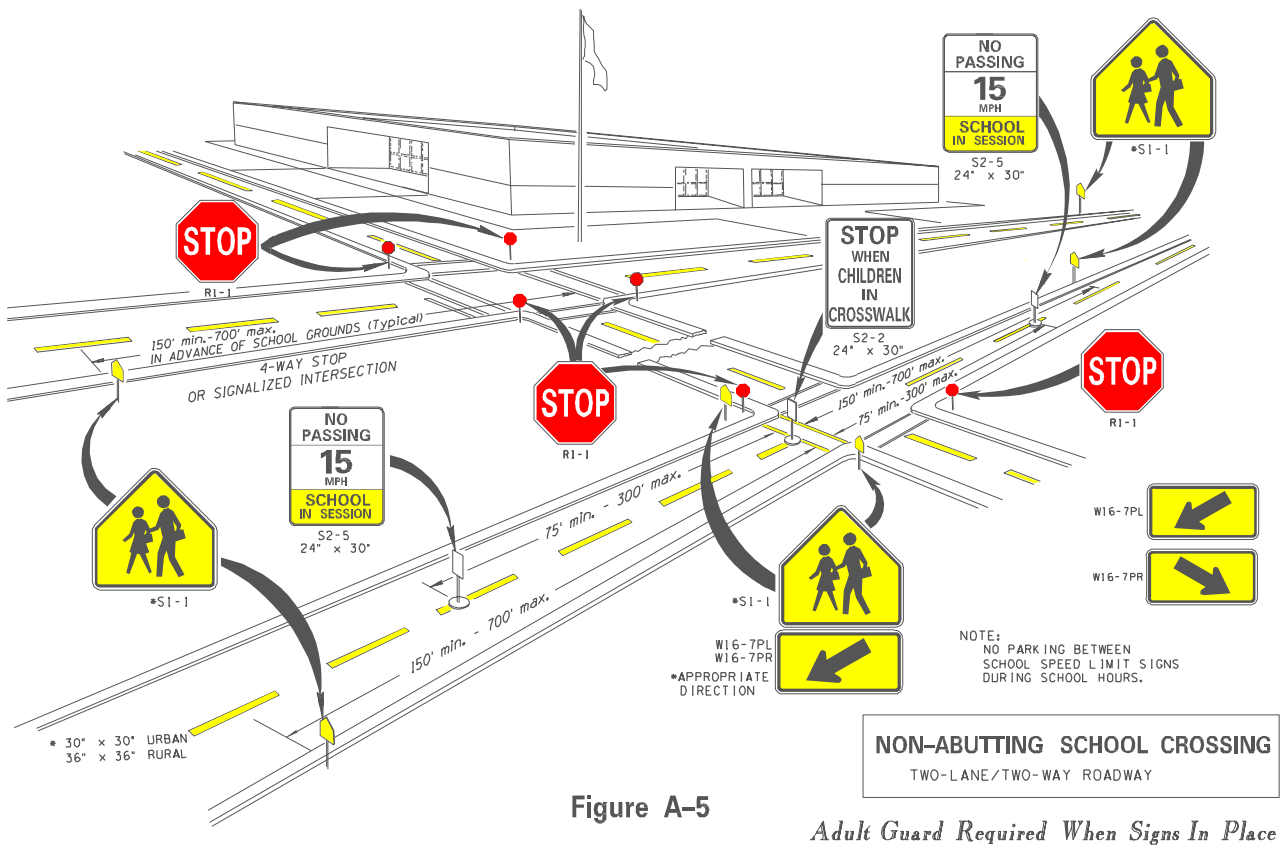


Figure A–5

Adult Guard Required When Signs In Place

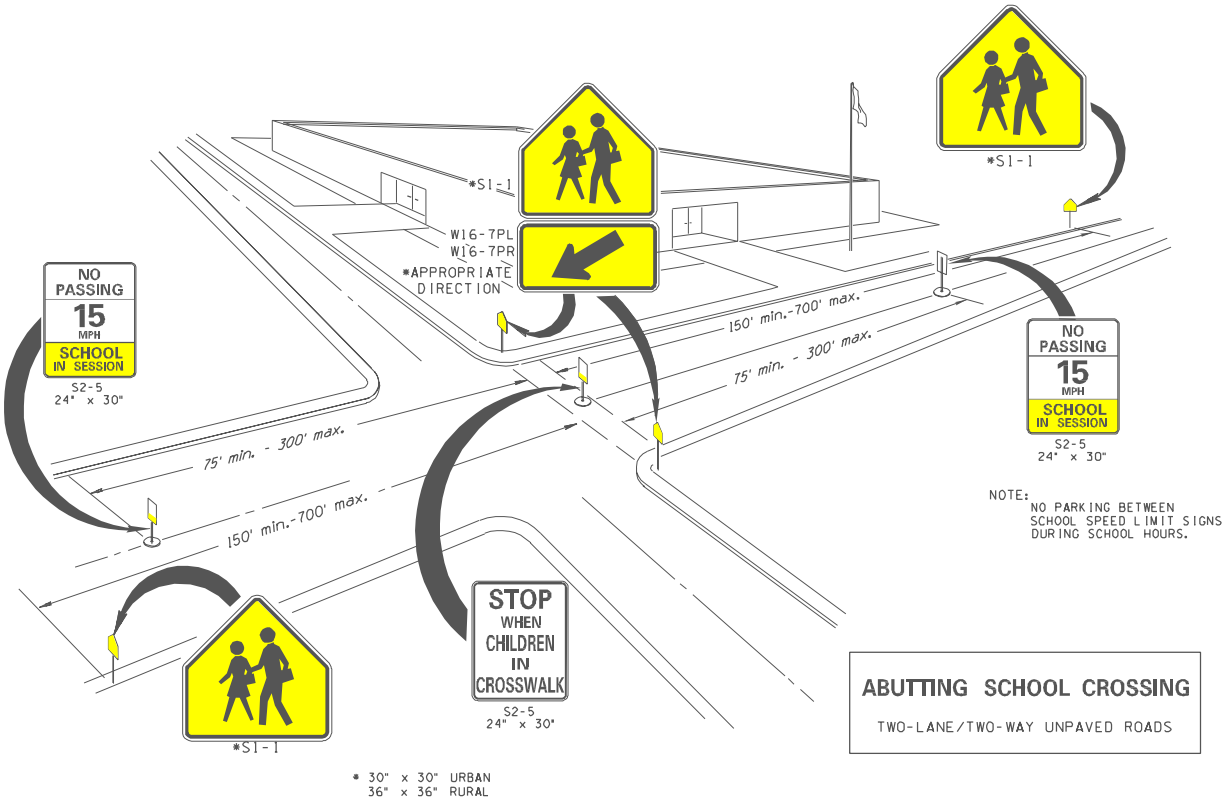


Figure A–6

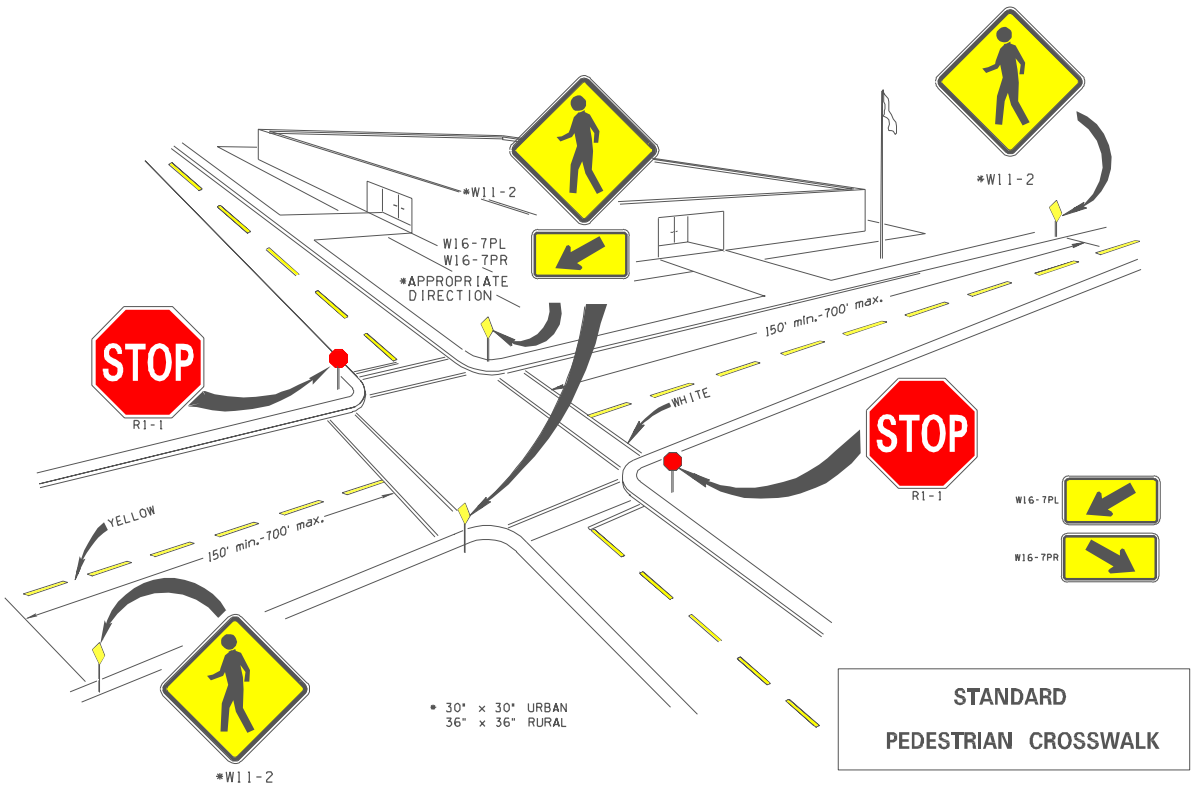
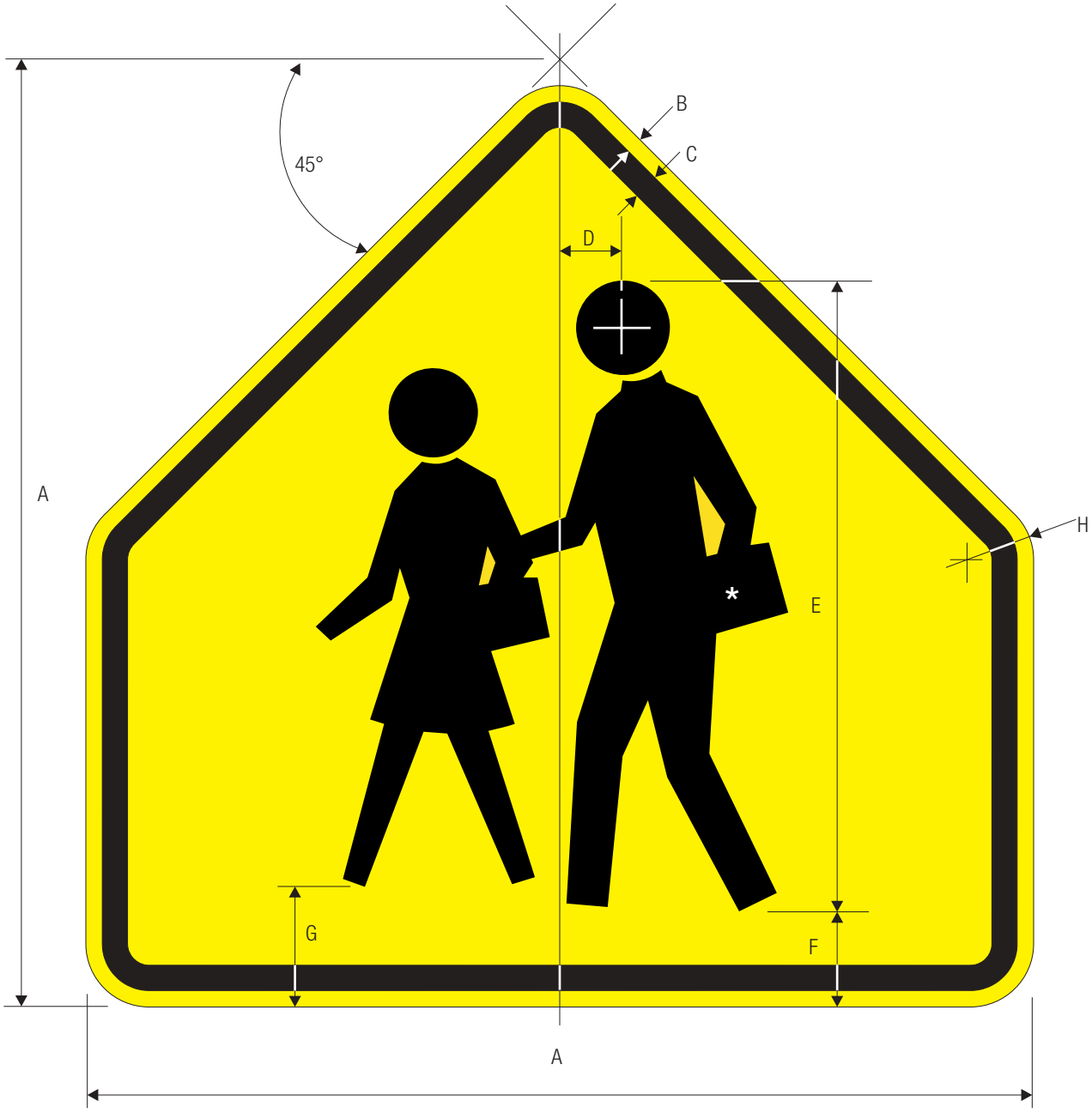


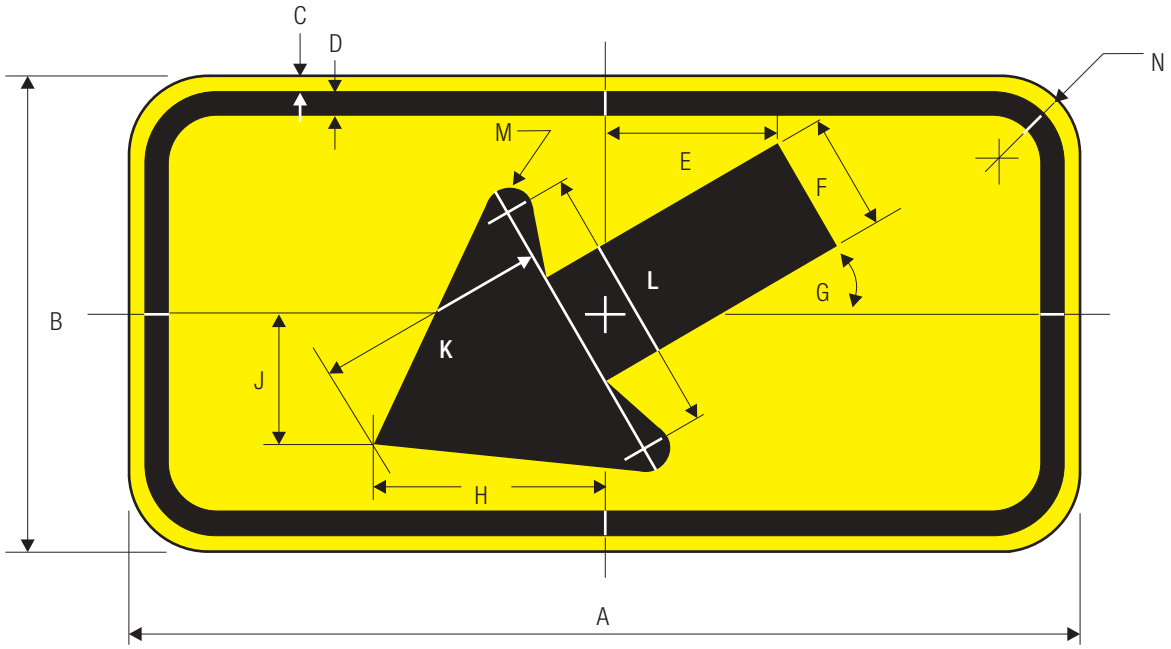
Figure A–7



S1-1

A	B	C	D	E	F	G	H
30	.5	.75	2	20	3	3.75	1.875
36	.625	.875	2.5	24	3.5	4.5	2.25
48	.75	1.25	3.25	32	5	6	3

COLORS: LEGEND — BLACK
BACKGROUND — YELLOW (RETROREFLECTIVE)

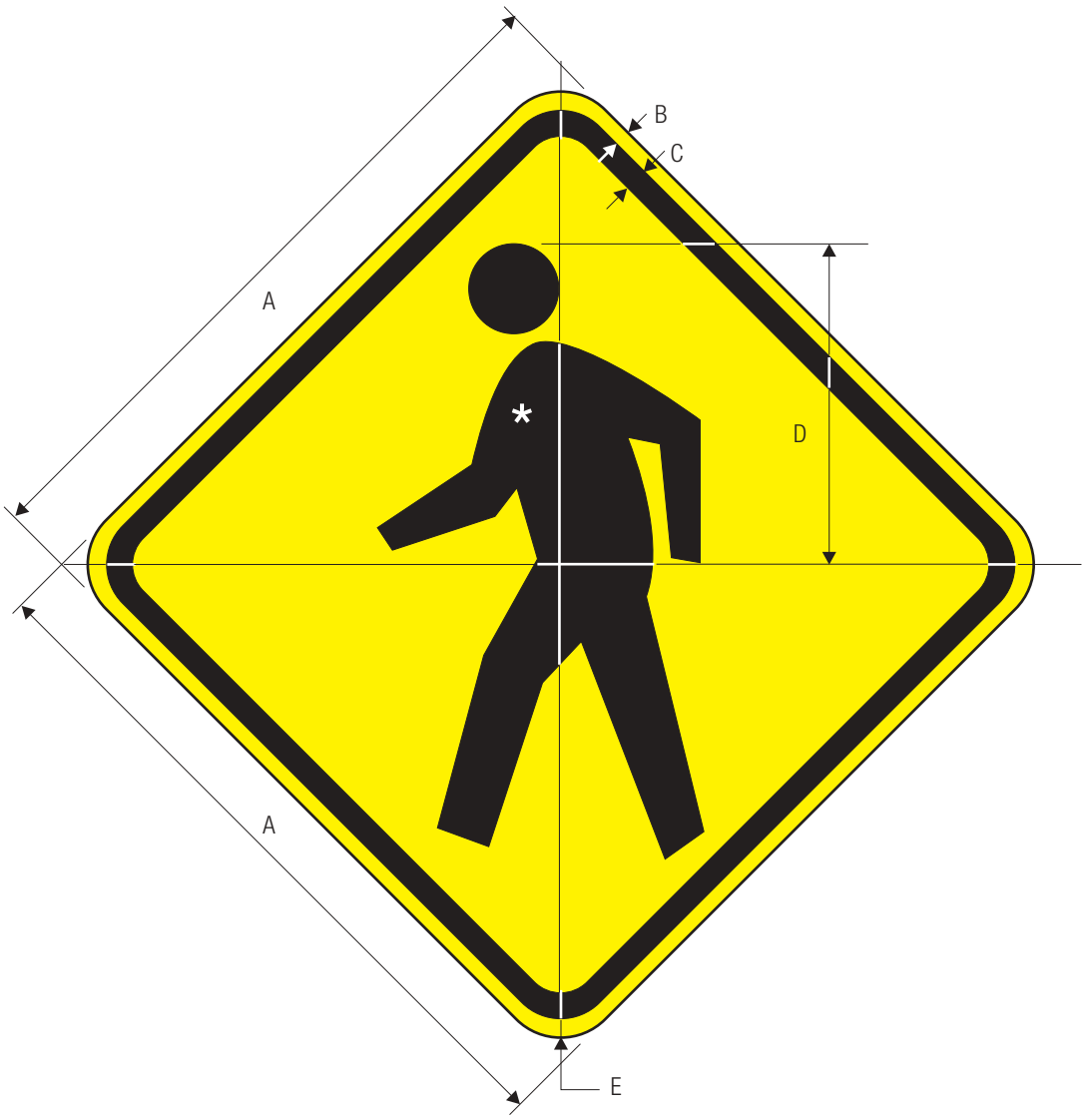


W16-7pL

A	B	C	D	E	F	G	H	J	K	L	M	N
24	12	.375	.625	4.323	3	30°	5.844	3.282	5.884	6.925	.600	1.5
30	18	.5	.75	6.524	4.5	30°	8.766	4.923	8.846	10.407	.920	1.875

W16-7pR

COLORS: LEGEND — BLACK
BACKGROUND — YELLOW (RETROREFLECTIVE)



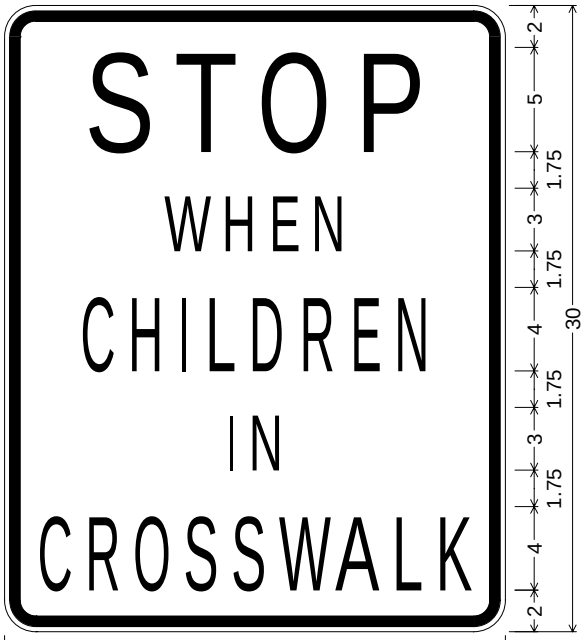
W11-2

A	B	C	D	E
24	.375	.625	11	1.5
30	.5	.75	13.5	1.875
36	.625	.875	16	2.25
48	.75	1.25	22	3

COLORS: SYMBOL — BLACK
BACKGROUND — YELLOW (RETROREFLECTIVE)

CODE: S2-2

SIZE: 24" x 30"
STANDARD



S02-02(24x30-STD)WHT;

1.500" Radius, 0.500" Border, 0.250" Indent, Black on White;

"STOP" D; "WHEN" C; "CHILDREN" B; "IN" C;

"CROSSWALK" B;

Table of letter and object lefts.

S 3.875	T 8.125	O 12.125	P 16.750

W 7.625	H 10.375	E 12.750	N 14.750

C 3.625	H 5.875	I 8.375	L 9.625	D 11.750	R 14.125	E 16.625	N 18.625

I 10.625	N 11.750

C 1.625	R 3.875	O 6.125	S 8.625	S 10.875	W 13.125	A 15.875	L 18.625	K 20.625

ALL DIMENSIONS ARE IN INCHES

COLORS:

LEGEND & BORDER - BLACK (NON-REFL)

BACKGROUND - WHITE (REFL)

ARIZONA DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING GROUP

DRAWN	DATE
L. LOPEZ	4/03

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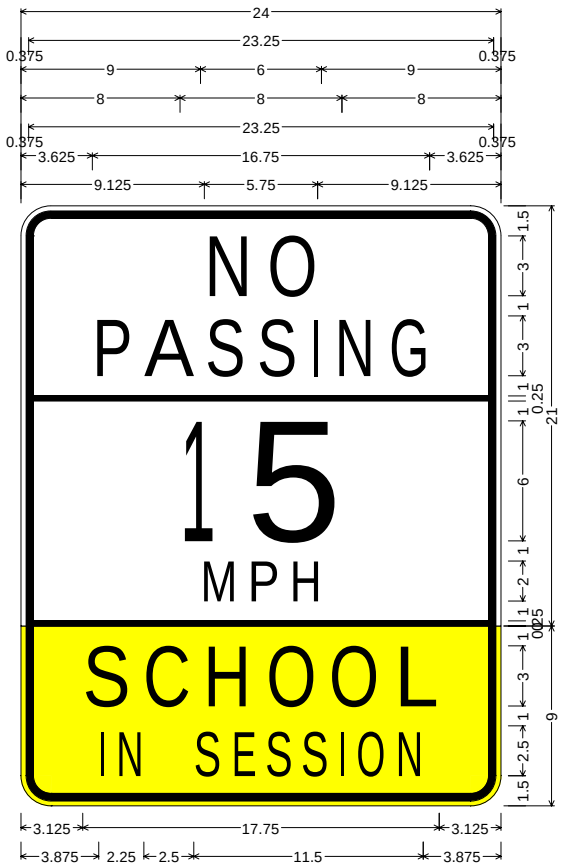
SIGNATURE ON FILE

CODE: S4-5

SIZE: 24" x 30"
STANDARD



S04-05(24x30-STD)WHT-YEL;
1.500" Radius, 0.375" Border, 0.250" Indent, Black on White;
"NO" E Mod; "PASSING" D; "15" E Mod; "MPH" E Mod;
1.500" Radius, 0.375" Border, 0.250" Indent, Black on Yellow;
"SCHOOL" E Mod; "IN SESSION" C;
Table of letter and object lefts.

N 9.125	O 12.375

P 3.625	A 6.125	S 9.250	S 11.750	I 14.500	N 15.750	G 18.375

— 0.375

I 8.000	5 11.250

M 9.000	P 11.375	H 13.375

— 0.375

S 3.125	C 6.125	H 9.125	O 12.250	O 15.375	L 18.625

I 3.875	N 4.750	S 8.625	E 10.500	S 12.250	S 14.000	I 15.875	O 16.750	N 18.750

ALL DIMENSIONS ARE IN INCHES

COLORS:

LEGEND & BORDER - BLACK (NON-REFL)
TOP BACKGROUND - WHITE (REFL)
BOTTOM BACKGROUND - YELLOW (REFL)

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TRAFFIC ENGINEERING GROUP

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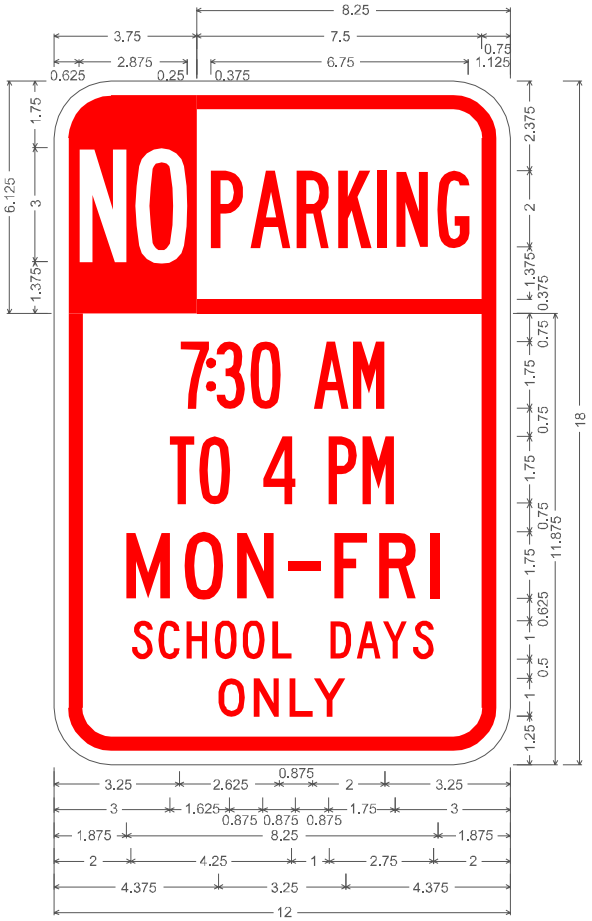
SIGNATURE ON FILE

CODE R7-13
STANDARD



R07-13(12x18-STD)WHT-RED;
1.500" Radius, 0.375" Border, White on Red;
[NO] B 40% spacing;
1.500" Radius, 0.375" Border, 0.375" Indent, Red on White;
[PARKING] B 60% spacing;
1.500" Radius, 0.375" Border, 0.375" Indent, Red on White;
[7:30 AM] B 50% spacing; [TO 4 PM] B 50% spacing;
[MON-FRI] C; [SCHOOL DAYS] C; [ONLY] D;
Table of letter and object lefts.

N 0.625	O 2.125											
P 4.125	A 5.125	R 6.375	K 7.500	I 8.500	N 9.000	G 10.000						
— 3.750												
7 3.250	: 4.000	3 4.250	0 5.125	A 6.750	M 7.875							
T 3.000	O 3.875	4 5.500	P 7.250	M 8.125								
M 1.875	O 3.375	N 4.750	- 6.125	F 7.375	R 8.500	I 9.875						
S 2.000	C 2.750	H 3.500	O 4.250	O 5.000	L 5.750	D 7.250	A 8.000	Y 8.625	S 9.375			
O 4.375	N 5.250	L 6.125	Y 6.875									

ALL DIMENSIONS ARE IN INCHES

COLORS

LEGEND - RED & WHITE (REFL)
BORDER & BACKGROUND - WHITE (REFL)

ARIZONA DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING GROUP

DRAWN	DATE
L. LOPEZ	4/03

APPROVED

Appendix B

School Crossing Warrants

Average Time Between Gaps Warrant	Maximum 10 Points
"School Age" Pedestrian Volume Warrant	Maximum 10 Points
85th Percentile Approach Speed Warrant	Maximum 5 Points
Average Demand Per Gap Warrant	Maximum 8 Points
Maximum Total Points	33 Points

The minimum warrant for the installation of a marked school crosswalk is satisfied when a location rates at least one point for "School Age" pedestrian volumes and has an overall total of at least 16 points in an urban area, or 12 points in an isolated community of under 10,000 population (rural).

Point Assignment

1. Average Time Between Gaps

Point assignments is based on the period of time when 80% of the crossing activity takes place on the way to or from school (evaluation period).

Average Minutes Between Usable Gaps In Traffic	Points
Less than 1	0
1.01 – 1.25	2
1.26 – 1.67	4
1.68 – 2.50	6
2.51 – 5.00	8
Over 5	10
Maximum	10

2. "School Age" Pedestrian Volume Warrant

Points are assigned in accordance with the total number of "School Age" pedestrians Crossing at the study location on the way to or from school during the evaluation period. A school crossing will not be installed where the "school age" pedestrian volume is 10 or less

"School Age" Pedestrian Total During Evaluation Period		
Urban	**Rural**	**Points**
10 or less	10 or less	0
11 – 13	11 – 20	2
31 – 50	21 – 35	4
51 – 70	36 – 50	6
71 – 90	51 – 65	8
Over 90	Over 65	10
	Maximum	10

3. 85th Percentile Approach Speed or Posted Speed Warrant

Points are assigned in accordance with the vehicular approach speed from both directions of travel as determined through engineering speed studies. No school crosswalks should be installed on roadways having 85th percentile or posted speeds in excess of 45 mph.

Approach Speed	Points
Under 20	0
20 – 25	1
26 – 30	2
31 – 35	3
36 – 40	4
41 - 45	5
Over 45	0
Maximum	5

5. Average Demand Per Gap Warrant

Points are assigned in accordance with the average number of demands per gap during the evaluation period. Since school children frequently walk in groups, the arrival of each individual, or group at the crossing location should be construed as one demand, i.e., the arrival of a group of three, one individual, a group of two and another individual constitute four demands.

Average Demand Per Gap	Points
1 or less	0
1.01 – 1.67	2
1.68 – 2.33	4
2.34 – 3.00	6
Over 3.00	8
Maximum	8

Survey Methods and Field Form

I. Survey Methods:

A. Personnel Requirements: One man

B. Duration of Survey: Forty-five minutes before school starts in the morning or 30 after school ends in the afternoon.

C. Equipment: Stop watch and field data forms.

D. Type of Survey:

1. "School Age" Pedestrian count within the crosswalk area during the study period.

2. Usable Gap Time count during the same study period.

   a. Each gap that is equal to or exceeds the calculated "school age" pedestrian crossing time is defined as a Usable Gap Time and is entered on the field data form as such.

3. Speed samples should be obtained by radar.

II. Use of the Crosswalk Warrant Field Form:

A. Compute the "School Age" Pedestrian Crossing Time and enter the figure (in seconds) in the appropriate space.

B. Begin the Usable Gap Time recording by entering on the field data sheet the length (in seconds) of those gap times equal to or exceeding the calculated "School Age" Pedestrian Crossing Time.

C. To calculate the maximum number of usable gaps, total the Usable Gap Times during the evaluation period and divide by the "School Age" Pedestrian Crossing Time.

D. To obtain average minutes between gaps, divide the evaluation period (minutes) by the maximum number of usable gaps.

E. Record the average time between gaps, the "School Age" pedestrian volume, the approach speed, and the average number of demands per gap.

F. Evaluate the individual warrants, assign points as merited, and tabulate to determine if a marked school crosswalk installation is justified.

Formulas

(1) "School Age" Pedestrian Crossing Time = $\frac{W}{3.5} + 3 + 2(N-1)$

$\frac{W}{3.5}$ = crossing time in seconds (critical width in feet of pavements to be crossed, W, divided by the assumed juvenile pedestrian walking speed of 3.5 feet per second).

3 = pedestrian perception and reaction time (the number of seconds required for a child to look both ways, make a decision, and commence to walk across the street).

2(N – 1) = pedestrian clearance time (additional seconds of time required to clear large groups of children from the roadway). Children are assumed to cross the roadway in rows of five with two-second time intervals between each row. The clearance time is equal to 2(N - 1) where N is the number of rows, 1 represents the first row and 2 the time interval between **rows.**

(2) Average Minutes between Gaps = $\frac{\textbf{Time Interval (In Minutes) during E.P.*}}{\textbf{Maximum Number of Usable Gaps}}$

(3) Average Number of Demands per Gap = $\frac{\textbf{Total Demands during E.P.}}{\textbf{Max. No. of Usable Gaps}}$

Appendix C

Arizona Revised Statute 28-797
School Crossings

A. The Director, with respect to state highways or the officer, board or commission of the appropriate jurisdiction, with respect to county highways or city or town streets, by and with the advice of the school district governing board or superintendent of schools may mark or cause to be marked by the department or local authorities crosswalks in front of each school building or school grounds abutting thereon where children shall be required to cross the highway or street.

B. Additional crossings across highways not abutting on school grounds may be approved by the department, or local authorities, upon application of school authorities, with written satisfactory assurance give the department or local authorities that guards will be maintained by the school district at the crossings to enforce the proper use of the crossing by school children.

C. The sign manual shall provide for yellow marking of the school crossing, yellow markings of the center line of the roadway and the erection of portable signs indicating that vehicles must stop when persons are in the crossing. The manual shall also provide the type and wording of portable signs indicating that school is in session, and permanent signs providing warning of approach to school crossings.

D. When such crossings are established, school authorities shall place within the highway the portable signs indicating that school is in session, placed not to exceed three hundred feet each side of the school crossings, and “Stop When Children in Crosswalk” signs at school crossings. School authorities shall maintain these signs when school is in session and shall cause them to be removed immediately thereafter.

E. No vehicle approaching the crosswalk shall proceed at a speed to exceed fifteen miles per hour between the portable signs placed on the highway indicating “School in Session” and “Stop When Children in Crosswalk”.

F. When the clause “School in Session” is used in this section, either referring to the period of time or to signs, it means during school hours or while children are going to or leaving school during opening or closing hours.

G. When the school authorities place and maintain the required portable “School in Session” signs and “Stop When Children in Crosswalk” signs, all vehicles shall come to a complete stop at the school crossing when the crosswalk is occupied by any person.

H. Notwithstanding any other provision of law, a school crossing may be established on an unpaved highway or street adjacent to a school when the agency of appropriate jurisdiction determines the need for such school crossing on the basis of a traffic study. School crossings on unpaved highways and streets shall be marked by the use of signs as prescribed in the Manual on Uniform Traffic Control Devices.

I. Notwithstanding any other law, a local authority may establish a school crossing at an intersection containing a traffic control signal if the local authority determines, on the basis of a traffic study, the need for such a school crossing.

Appendix D
Application and Operating Agreement for School Crossing

Director
Arizona Department of Transportation
206 South 17th Avenue
Phoenix, Arizona 85007

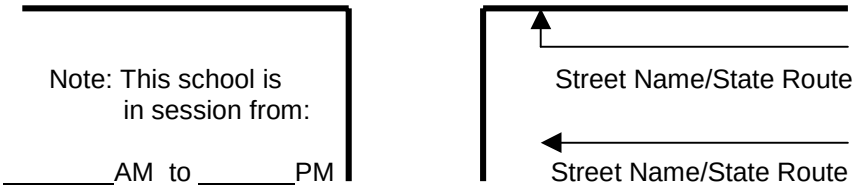
Crossing Code Number _____

Dear Sir:

In accordance with the provisions of Section 28-797 of the Arizona Revised Statutes, application is hereby made for a school crossing at the located indicated on the following diagram:

☐ Abutting

☐ Non-Abutting



The undersigned school authority agrees to administer all duties as prescribed in Section 28-797 of the Arizona Revised Statutes, to operate the crossing in conformance with the Arizona Department of Transportation's Traffic Safety for School Areas, and when required, to provide an adult guard at the crossing during the periods of normal usage.

ADULT GUARD

☐ Required

☐ Not Required

_____
School District

_____
School

_____ ☐ Non Public
City County

_____
Signature of School Authority Title Date

Approval is hereby granted for the school crossing, with the stipulation that portable signs may not be placed within the roadway prior to _____AM nor later than _____PM during school days, and that an adult guard, when required, be on duty during periods of normal usage.

_____
Authorizing Agency

_____
Approved Title Date